MIT's Oldest and Largest Newspaper

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The Tech
Established 1881

Volume 136, Number 4

Thursday, February 18, 2016

WEATHER, p. 2

THU: 35°F | 19°F
Partly cloudy

FRI: 37°F | 32°F
Partly cloudy

SAT: 49°F | 37°F
Chance rain/snow

After plans change, Met Warehouse will not become a dorm

The building may still host retail, study spaces, and maker spaces

By Karleigh Moore and William Navarre
EDITORS

The Metropolitan Moving & Storage Warehouse will not become a dorm. Instead, a new undergraduate residence will be constructed "from the ground up," most likely in West Campus.

The administration plans to reuse the warehouse "in a number of creative ways." The building might eventually feature street-level retail, maker spaces, study spaces, and "innovation spaces," Associate Provost Karen K. Gleason told *The Tech*.

"We need to renovate some of our older residence halls," Gleason said, explaining the need for a new dorm. "[N]ew housing will allow us to accommodate the housing needs of all students while those buildings are under construction."

Administrators are still in the early stages of planning out the work to be done. Gleason said the plans to turn the Metropolitan building into a dorm were abandoned "just over the past couple of weeks," and timelines for each construction project have yet to be worked out but will be forthcoming.

Uncertainty and fear that it would be impossible to house students in the Metropolitan building by Sept. 2018 prompted administrators to change course.

Metropolitan, Page 9

ROBERT RUSCH—THE TECH

Metropolitan Warehouse may house maker spaces, but no students.

Apple opposes order to unlock shooter's phone

Company says order is invasive, calling it a breach of privacy and vowing to appeal

By Katie Benner and Eric Lichtblau
NEW YORK TIMES

WASHINGTON — Last month, some of President Barack Obama's top intelligence advisers met in Silicon Valley with Apple's Timothy D. Cook and other technology leaders in what seemed to be a public rapprochement in their long-running dispute over the encryption safeguards built into their devices.

But behind the scenes, relations were tense, as lawyers for the Obama administration and Apple held closely guarded discussions for over two months about one particularly urgent case: The FBI wanted Apple to help "unlock" an iPhone used by one of the two attackers who killed 14 people in San Bernardino, California, in December, but Apple was resisting.

When the talks collapsed, a federal magistrate judge, at the Justice Department's request, ordered Apple to bypass security functions on the phone, setting off a furious public battle Wednesday between the Obama administration and one of the world's most valuable companies in a dispute with far-reaching legal and implications.

"This Apple case really goes right to the heart of the encryption issue," said Ira Rubinstein, a senior fellow at New York University's Information Law Institute, "and in some ways, this was a fight that was inevitable."

This is not the first time a technology company has been ordered to effectively de-encrypt its own product, but industry experts say it is surely the most significant because of Apple's huge global profile, the invasive steps it says are being demanded, and the notoriety of the San Bernardino attacks.

Law enforcement officials who support the FBI's position said that the impasse with Apple provides an ideal test case to move the long-simmering encryption issue from an abstract debate over the balance between national security and privacy to a concrete one.

Apple, Page 12

IN SHORT

Minor completion forms for final-term seniors are due Friday. Those submitting the form late will face a $50 late fee.

Add date is March 4; students should ensure that they are enrolled in all classes they plan to attend.

MIT's MENA Career Fair, which features opportunies in the Middle East and North Africa, will take place Saturday from 10 a.m. to 3 p.m.

Send news and tips to *news@tech.mit.edu*.

MIT physicists weigh in on the significance of LIGO discovery

Three physicists discuss the implications for the future of physics, their roles in the discovery of gravitational waves

By Drew Bent
FEATURES EDITOR

MIT physicists gathered in the Bush Room under MIT's dome on Feb. 11 to share some important news. The world knows what came next: in parallel with an event at the National Science Foundation, the scientists announced their breakthrough in making the first direct observation of gravitational waves. The cause of the waves was equally spectacular: a billion years ago, two black holes collided and outputted 50 times more power than all the suns in the universe.

The announcement was a triumph for basic research in science and a stellar example of the collaboration required for such technological advances: more than a thousand people worked together at the Laser Interferometer Gravitational-Wave Observatory (LIGO).

In the minutes leading up to the Bush Room announcement, emotions were running high for the MIT LIGO researchers present. Nothing had officially been stated, but everyone knew: this was big.

The Tech had the opportunity to talk with a few of the researchers involved, minutes before the news would go live, and listen to their raw views on the scientific and technological breakthrough.

Nergis Mavalvala — an MIT professor and the Associate Department Head of Physics, who played a prominent role in the LIGO research — shared her thoughts. Sebastien Biscans and Fabrice Matichard are two research engineers at LIGO who were also present at the announcement.

The Tech: Why is this important for science?

Mavalvala: I think the real importance of having made this detection of gravitational waves from binary black holes is ... there's three things there:

Gravitational waves: they exist, we can detect them, we have detectors that are finally sensitive to do so.

Binary black holes, that are 30 times more massive than our own sun. This is a mass range that we hadn't confirmed could really be there. The fact that they behave exactly as general relativity would predict is an amazing affirmation of the theory.

Finally, and most important to me, we're opening a new window into the universe and how we might be doing astronomy 10 years from now, 30 years from now, 100 years from now.

The Tech: I'm curious how this changes your research, and also if this changes anything about MIT physics?

Mavalvala: I think the way that it changes my research is that we now

LIGO, Page 2

Gravitational waves from collision of black holes detected

"Ladies and gentlemen, we have detected gravitational waves. We did it," David Reitze, Executive Director of the LIGO Scientific Collaboration, announced Feb. 11.

Physicists involved with LIGO, short for the Laser Interferometer Gravitational-Wave Observatory, went on to describe how they had detected a "chirp" resulting from the collision of two black holes 1.3 billion years ago, which represented the first direct evidence of gravitational waves and confirmed Einstein's theory of general relativity.

The theory predicted that two massive objects interacting would bend the fabric of spacetime and send gravitational waves rippling through the universe. The two LIGO detectors used in the discovery, located in Louisiana and Washington, are operated by MIT and Caltech researchers, among many others.

The idea for LIGO was born at MIT during the late 1960s, so this discovery was more than fifty years in the making. In an email to the MIT community, President L. Rafael Reif celebrated the advancement of pure science: "Without basic science, our best guess never gets any better, and 'innovation' is tinkering around the edges."

— Emma Bingham

NO INTERNSHIPS FOR FROSH?
Think again.
OPINION, p. 4

PORTRAITS OF RESILIENCE
Treating PTSD as an injury, not a mental illness. **CAMPUS LIFE , p. 13**

THE BIGGEST TECHDOKU
Just remember to pay attention in class.
FUN, p. 6

COCAINE & RECORDS
Read our take on HBO's new '70s rock drama, Vinyl.
ARTS, p. 8

LOVE IS HEALTHY
Relationships should be too.
CAMPUS LIFE, p. 13

SECTIONS

WEATHER

A return to relative warmth

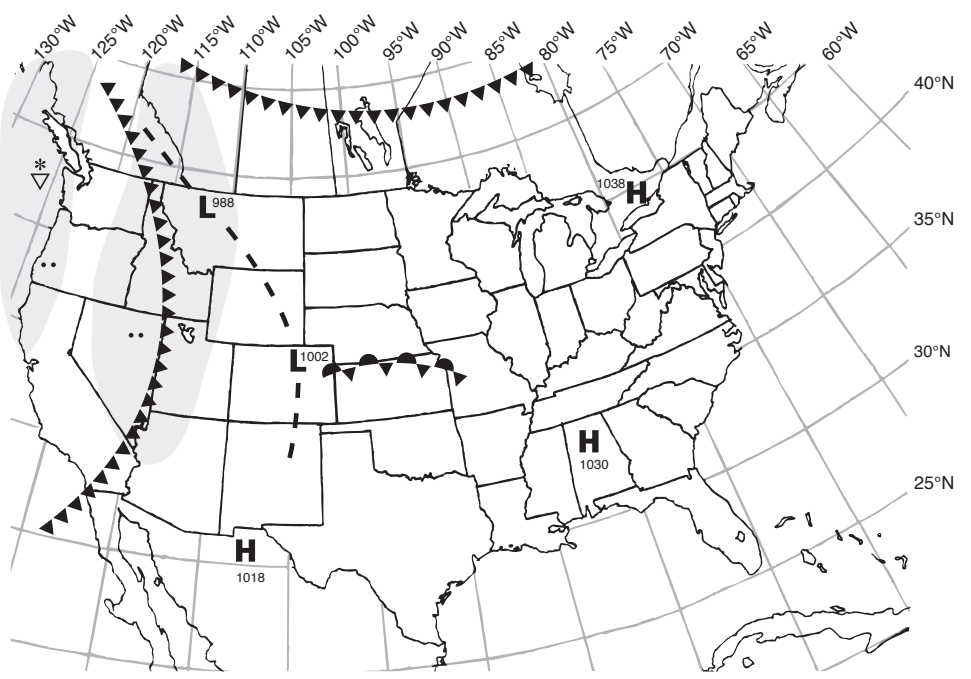
By Vince Agard
STAFF METEOROLOGIST

The Boston area is experiencing a return to climatologically normal temperatures after record cold enveloped the region over President's Day Weekend. The most severe part of the cold outbreak came on Sunday, when both the high (12°F) and low (-9°F) temperatures were the coldest ever observed in Boston on February 14. An extraordinarily cold polar air mass was to blame for the frigid outbreak, which spread throughout the northeastern United States. The unique extremity of the cold air mass was captured by a weather balloon measurement in Albany, New York, on Saturday night, which measured -23.4 °F at the 850 millibar level (a height of about 1.4 kilometers) — the coldest temperature ever observed at that height in Albany.

Things changed on Tuesday and Wednesday, when high temperatures easily exceeded the climatological normal of 39°F. A cold front passing through this morning will cause today's temperatures to be a bit lower, with temperatures dropping into the teens (°F) tonight under clear skies and calm winds. Warm weather will return for the weekend, with temperatures reaching the upper 40s (°F) on both Saturday and Sunday. Numerical weather prediction models indicate the possibility for a large storm to impact the area around the middle of next week, but there is a great deal of uncertainty concerning the storm's track, and it is therefore too soon to predict the type or amount of precipitation.

Extended Forecast

Today: Partly cloudy. High 35°F (2°C). Winds N at around 10 mph.
Tonight: Clear. Low 19°F (-7°C). Winds calm.
Tomorrow: Partly cloudy. High 37°F (3°C). Winds S at around 5 mph.
Saturday: Mostly cloudy with a chance of rain or snow showers. High 48°F (9°C).
Sunday: Mostly sunny. High 48°F (9°C).



Situation for Noon Eastern Time, Thursday, February 18, 2016

Weather Systems	Weather Fronts	Precipitation Symbols			Other Symbols
			Snow	Rain	
H High Pressure	Trough	Showers	* ▽	• ▽	Fog
L Low Pressure	Warm Front	Light	*	•	Thunderstorm
§ Hurricane	Cold Front	Moderate	**	••	Haze
	Stationary Front	Heavy	⁂	∴	Compiled by MIT Meteorology Staff and *The Tech*

Discovery provides researchers with guidance as to where to expend more resources, Mavalvala said

Over 1,000 people from around the world worked on the project, which confirmed Einstein's theory of general relativity; says professor, 'the biggest changes are yet to come'

LIGO, from Page 1

have some direction to go in, in terms of the astrophysics, but also in terms of the instrument kit. Most of my work over my career has been on making better and better detectors, and this sort of informs people like me, where do we need to put our resources? Do we need a better detector at low frequencies? At high frequencies?

I actually think the biggest changes are yet to come, because, you know, we've detected the very first things. Imagine if in the next observing run, we see something and we have no idea what it is.

I think it's wide open still, even though we have some guidance now that we didn't have before. We're still moving ahead trying to make better and better instruments.

The Tech: When you got into this work, did you ever imagine that your work would help lead to something like this?

Mavalvala: You know, yes and no. I started as a graduate student in gravitational waves, with Rai Weiss. And you know, we believed it was around the corner. Twenty-five years later, we've done it, but if I had known it was 25 years, maybe I wouldn't have started. But the truth is once I started, it was really an amazing thing to work on, in part because of the payoff of being able to open up this new window into the universe, but also in part because of the sheer level of technological prowess that's needed to pull this off. I was really wowed by all the people I worked with. I would do it again even if I knew it was going to be 25 years more.

The Tech: What's your role in this?

Biscans: We're part of the LIGO team here at MIT. Personally, I've been working for 6 years on the project, especially on the platform where the optics and all the interferometer is built on: what we call the seismic platform ... It's to prevent the ground motion from making too much noise for the mirrors.

Matichard: I was a lead engineer on the seismic isolation systems, leading design and testing, and the installation of all the platforms needed.

The Tech: What was the overall collaboration like? How many people were involved?

Biscans: I don't know the exact number, but a lot — more than a thousand.

Matichard: We're organized into groups. For example, in our case, we're the group in charge of seismic isolation, and we have partners in Stanford and in other universities. There are some subgroups on each site. Several times a week we meet on teleconference.

Biscans: You have people from all over the world and different backgrounds. I think that's why the project is great, because you're working with so many different people from all around the world.

The Tech: How would you explain the importance of this discovery to the public?

Biscans: To be very general, right now, one of the only ways we have to observe the universe is looking at light, and this is a totally new way to look at the universe. We call that the sound of the universe. Gravitational waves are kind of the sound of the universe. It's like a totally new approach and new way to observe the universe, and hopefully by having this new way of observing the universe, we're going to answer other cosmological questions. So it's a totally new path, a new way in astrophysics. That's why I think it's awesome.

Matichard: And obviously, it's a first direct detection of those gravitational waves predicted by the theory of general relativity of Einstein.

Biscans: One hundred years!

This interview has been edited and condensed for clarity.

LETTERS TO THE EDITOR

Freshmen internships: a bit elusive, but not impossible (and not all there is!)

Last week, *The Tech* ran a piece near and dear to the hearts of all of us at MIT's Career Services: In search of an elusive freshmen internship by Zachary Collins.

Zach's article honestly describes the challenges freshmen face trying to find an internship for the summer before their sophomore year. We were very heartened to read that xFair wasn't a bust for him, even if it didn't result in an internship. Despite not satisfying a short term goal, Zach made progress towards a long term one. Hopefully his story encourages more students to attend our upcoming Spring Career Fair, as well as other fairs being offered this semester.

It's true that companies tend to hire more upperclassmen, but the data we collect suggests that the number of rising sophomores who get industry internships might be higher than you think. Of the 467 rising sophomores who responded to the 2013 Summer Experience Survey, 46 percent reported having worked in an internship, 51 percent reported work in a research lab and 3 percent reported other activities such as public service or travel. Be sure to check out the 2015 survey results later this spring semester.

More and more employers are learning that developing earlier relationships with college students is in their best interest. We remind them of this whenever we can. We emailed thousands of recruiters this IAP to encourage them to hire freshmen, and as a result more freshmen-friendly internships are now in our database, CareerBridge. Students can search with "freshmen" as a keyword to check them out.

Another way we promote freshmen to employers is F/ASIP, the Freshmen/Alumni Summer Internship Program. For almost 20 years, we've taught freshmen (like Zach!) the skills they need to find great opportunities, while working with companies to develop more freshmen-friendly internships for all freshmen.

MIT alumni are a great resource. We encourage our F/ASIP class — and all freshmen — to use the Alumni Association's Institute Career Assistance Network (ICAN) or LinkedIn's alumni tool to find alumni and connect with them for informational interviews.

We also recommend students really take advantage of CareerBridge, including opting in to internship alert emails and setting up job agents. The CareerBridge software is getting dated (and is being updated), but the jobs and resources in it are invaluable. We're available to answer any questions you might have about CareerBridge via email (gecd@mit.edu), and if you want to talk about your job search or career you can always come to our drop-in hours or schedule an appointment.

OK, one last pitch. Worst case scenario, you can't find an internship; there's still plenty of useful, resume-building stuff you can do! UROPs are a great way to get experience, and so are MIT's vast range of international opportunities. Recruiters often tell us they are impressed by students who go abroad.

This is where the "Global Education" part of GECD comes in. Our global advisors can help you find interesting things to do all over the world. You can start by checking out goglobal.mit.edu, and you can email globalmit@mit.edu to make an appointment.

The freshman internship can feel elusive, but MIT has so much to offer. Sometimes the trick is just getting the right help. Our job is to do everything we can to help MIT students, so we hope you'll come and see us. Maybe we can help you out — you'll never know unless you stop by GECD, right?

Scott Murray, Digital Communications Specialist & Career Advisor

Tamara Menghi, Associate Director for Employer Relations

MIT Global Education & Career Development

OPINION POLICY

Editorials are the official opinion of *The Tech*. They are written by the Editorial Board, which consists of Chairman Colleen Madlinger, Editor in Chief Katherine Nazemi, Managing Editor Vivian Hu, Executive Editor William Navarre, and Opinion Editor Claire Lazar.

Dissents are the signed opinions of editorial board members choosing to publish their disagreement with the editorial.

Letters to the editor, **columns**, and **editorial cartoons** are written by individuals and represent the opinion of the author, not necessarily that of the newspaper. Electronic submissions are encouraged and should be sent to *letters@tech.mit.edu*. Hard copy submissions should be addressed to *The Tech*, P.O. Box 397029, Cambridge, Mass. 02139-7029, or sent by interdepartmental mail to Room W20-483. All submissions are due by 4:30 p.m. two days before the date of publication.

Letters, columns, and cartoons must bear the authors' signatures, addresses, and phone numbers. Unsigned letters will not be accepted. *The Tech* reserves the right to edit or condense letters; shorter letters will be given higher priority. Once submitted, all letters become property of *The Tech*, and will not be returned. Letters, columns, and cartoons may also be posted on *The Tech*'s Web site and/or printed or published in any other format or medium now known or later that becomes known. *The Tech* makes no commitment to publish all the letters received.

Guest columns are opinion articles submitted by members of the MIT or local community.

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Sudoku I

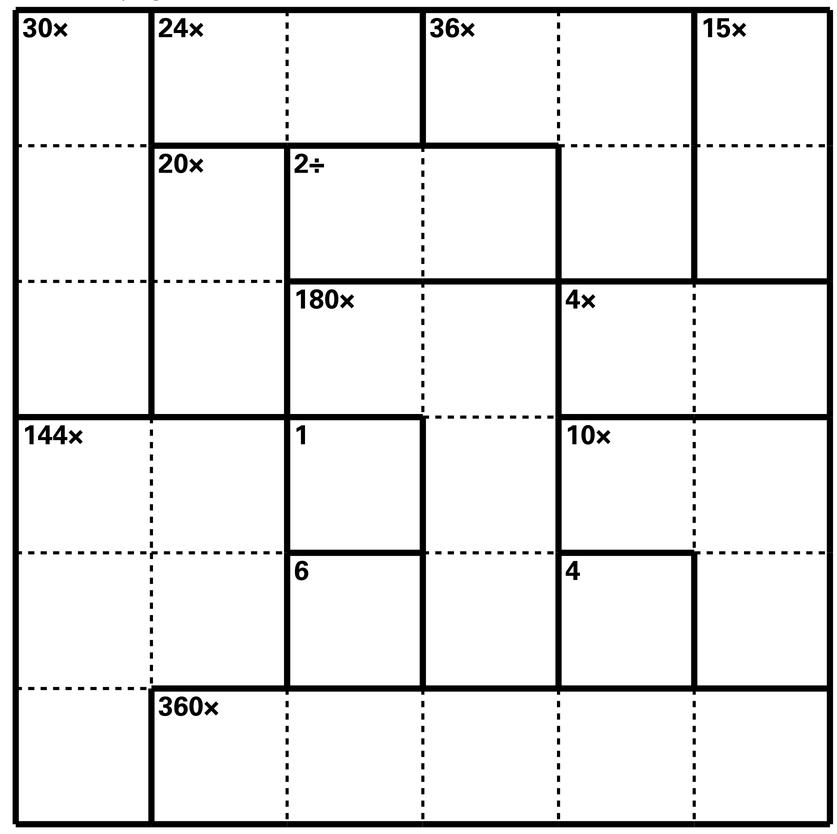
Solution, page 15

	6		7		9	8	4	
					4	2		
		5		1	8		9	3
				8		3		
	3						7	
		9		6				
1	2		4	7		9		
		6	8					
	9	7	5		1		6	

Instructions: Fill in the grid so that each column, row, and 3 by 3 grid contains exactly one of each of the digits 1 through 9.

Techdoku I

Solution, page 15



Instructions: Fill in the grid so that each column and row contains exactly one of each of the numbers 1–6. Follow the mathematical operations for each box.

Sudoku II

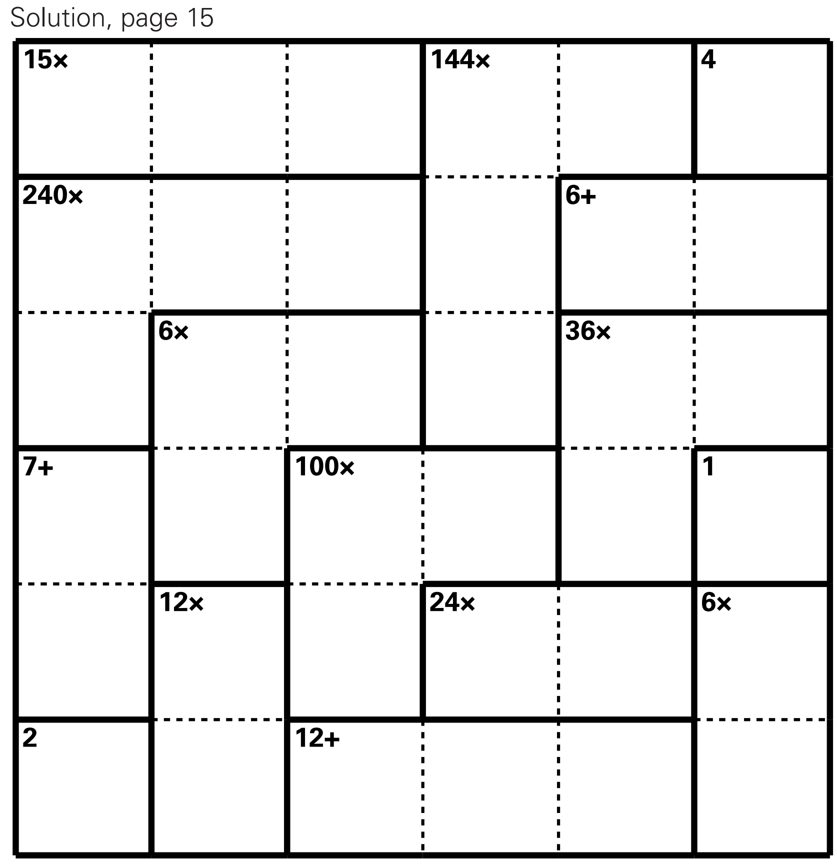
Solution, page 15

		1			6	8		
	6						7	1
			5	2		4		9
6	1			9				
		2	3	1	7	6		
				4			1	5
8		6		5	3			
1	9						8	
		7	1			9		

Instructions: Fill in the grid so that each column, row, and 3 by 3 grid contains exactly one of each of the digits 1 through 9.

Techdoku II

Solution, page 15



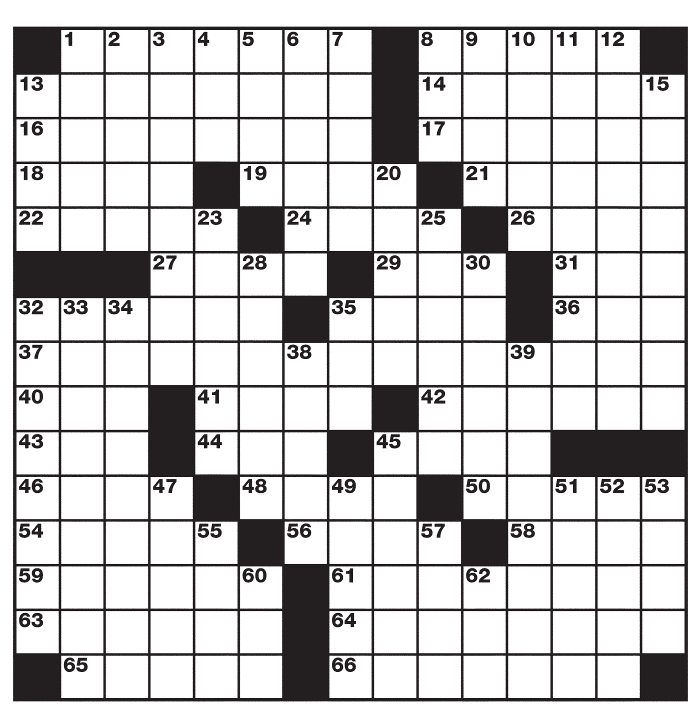
Instructions: Fill in the grid so that each column and row contains exactly one of each of the numbers 1–6. Follow the mathematical operations for each box.

Saturday Stumper by Anna Stiga

Solution, page 15

ACROSS
1 Many from Little Havana
8 Purse part
13 National Book Award nominee
14 Be jealous of, so to speak
16 Davy Crockett's rifle
17 One's diet
18 Tower of London's former function
19 Fine thread
21 Word associated with wines
22 Threaded object
24 Rafts, or where they may be found
26 Cybershopping convenience
27 One-third of sesqui-
29 Evasive maneuver
31 What to call a clipper
32 Possible smoothie ingredient
35 Tunnel-boring machine
36 Epithet
37 Enumeration qualification
40 Stock tip
41 Camera aperture
42 Is hot now
43 Oblige
44 Metal in much window glass
45 Betray unsteadiness
46 All __
48 Destined
50 Well-groomed
54 Slipped away
56 Theoretical trials
58 Workplace for many a would-be actor
59 Show up slowly
61 Five-star
63 Emphatic retort
64 Cybershops
65 Attuned
66 One not to be trusted

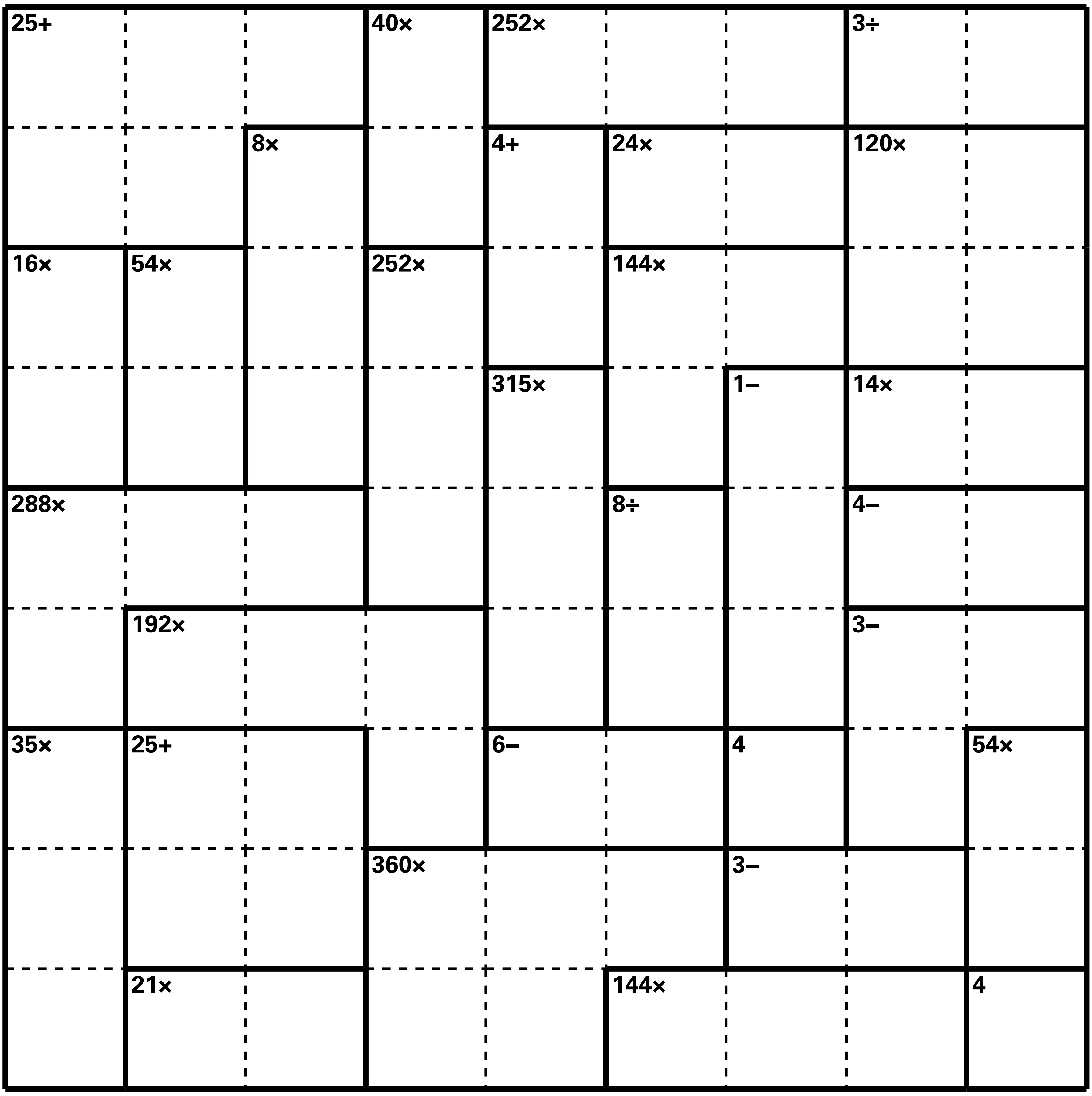
DOWN
1 Purple shade
2 That one/this one/both
3 Contractor's machine
4 Terre dans l'océan
5 Unimportant particulars
6 Basilica di San Francesco town
7 __ points
8 Frat letter
9 End up
10 Home office, perhaps
11 Elijah Wood's pal in three blockbusters
12 You can bet on it
13 They often 59 Across
15 Money metaphor from farming
20 Voice-activated buzzer
23 Increment on some counters
25 Tribute
28 Many kiwis
30 Literature classes
32 Medium-drain power source
33 LibriVox download
34 Color of many work boots
35 Hosts
38 Space near some bones
39 Revelatory



45 Aloof
47 Time stealer
49 Formalities
51 Served and gone
52 Give one's all with
53 Nicktoons target audience
55 Terrible
57 Go through the motions for practice
60 One of the first non-family Simpsons characters
62 Zoom

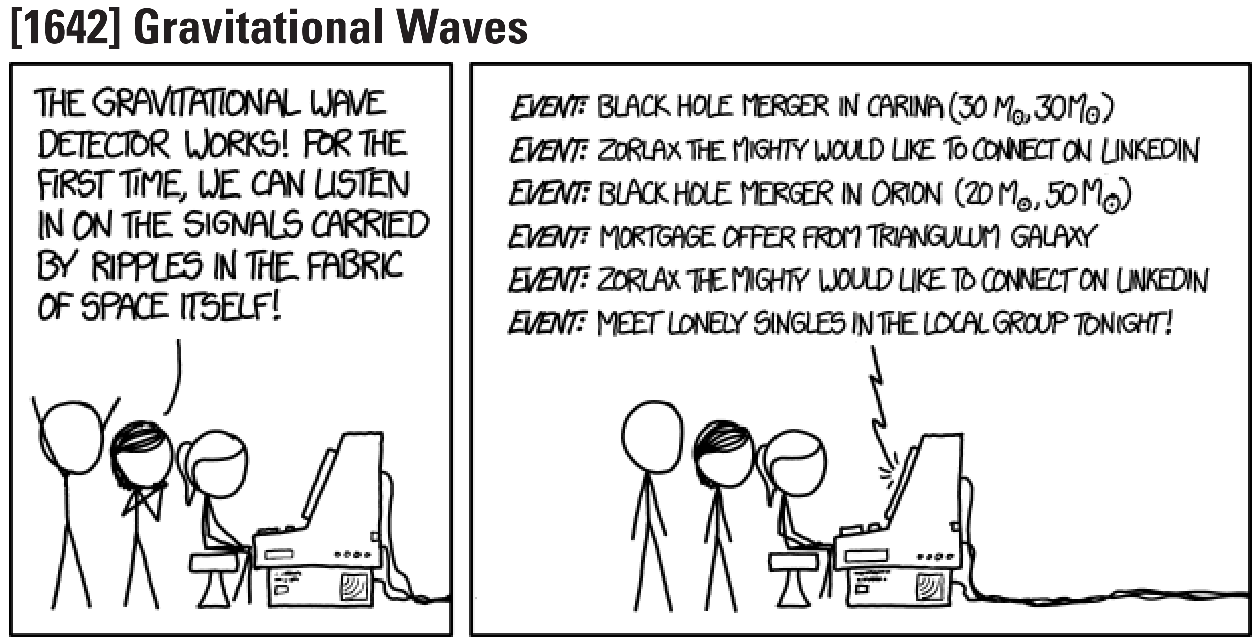
Big Techdoku

Solution, page 10



Instructions: Fill in the grid so that each column and row contains exactly one of each of the numbers 1–9. Follow the mathematical operations for each box.

[1642] Gravitational Waves



"That last LinkedIn request set a new record for the most energetic physical event ever observed. Maybe we should respond." "Nah."

xkcd

A webcomic of romance, sarcasm, math, and language

by Randall Munroe

EXHIBIT REVIEW

Ann Hirsch: "Sexy" (Un)Sublimated

Hirsch's satire is a little too poignant, a little too convincing, and a little too close to home

By Katie Arthur

I had never been in MIT LIST's project exhibition room before. It was smaller than I expected, and yet somehow this almost claustrophobic quality lent itself to Ann Hirsch's work. The darkened room was illuminated by the screens dotted about the walls, and the tiny crackles from the adjacent headphones were sporadically drowned out by the main speakers. With white fur rugs and black bean bags on the floor, it was easy to attach oneself to a screen and become immersed. This learned transportational quality of screens — our ability to willfully submit to their immaterial reality and allow it to transcend our surroundings — became more visible and reflexive as I explored each piece.

This camp mockery of sensuality is somehow liberating — it is an embodiment that goes beyond the sexuality portrayed in music videos even while seeking to attain it.

I was initially drawn to the stencil of a TV screen on the wall, and settled in for the video. The piece *Here for You (Or My Brief Love Affair with Frank Maresca)* (2010), begins with Ann's (playing "Annie") audition tape for a reality TV show, in which she competes with other women for Frank's affection, in his parents' house. A montage of Ann's experiences in the house shows the other girls dolling her up for her date with Frank, and culminates in her performing an explicit rap song that gets her cut from the show. What is perhaps most striking is the aspect of performativity that Ann's presence in the show unravels. At times, the footage will cut to a shot of Ann that carefully underpins this image of Annie as a sweet and hopeless girl. The viewers oscillate between their knowledge of Ann's performative role as Annie, and the TV program's formal construction of reality through different tropes and techniques, and this awareness creates a strange alienation from both.

This jarring dislocation works alongside our ability to self-immerse, forcing us to question our position as audience member and consumer. This rendering of the absurd is even more evident in Hirsch's *The Scandalishious Project* (2008-2009). In this compilation, as you plug into the top left screen with your headphones, you are greeted by a series of videos by "Caroline" — Hirsch's alter-ego. When I got to the screen, the video playing showed Caroline dancing in her bathroom in a zebra onesie. Her awkward fumblings are stark, and she seems oblivious and simultaneously hyperaware of the sexuality her hip gyrations connote, falling somewhere between the simulacra of sexy and dad-dancing. This camp mockery of sensuality is somehow liberating — it is an embodiment that goes beyond the sexuality portrayed in music videos even while seeking to attain it.

The next video is entitled "Letters to an Internet Whore" and features Caroline, with her quintessential vocal fry, reading fan mail. Ranging from Kevin's very specific request for skin-tight jeans, to 14 year old Emily's appreciative reverence, to Cilia's hate mail, this video alludes to the incitement of the audience Hirsch's work calls for. Like the screen of scrolling YouTube comments beneath it, reactions range from admiration to death threats. As the comments pass in an endless stream, ranging from accusations of attention-seeking, to body shaming, to sexual harassment, you get an overwhelming sense of what an ugly place the Internet can be at times.

The text introducing the exhibition states that Hirsch's aim with this piece was to "undermine stereotypes of the young women on the web by combining the geek, the needy oversharer, and the provocative dancer." She achieves this through an unsubtle over-identification with each of these stereotypes. Her dancing to Nelly Furtado's "Man Eater" or her video blog about "How to dress like a hipster without wearing brands" are a little too convincing, too recognizable.

Two screens to the right take this even further by screening video responses to Caroline's online oeuvre. Some of them are hilarious, including a guy dancing topless (and badly) to "Message in a Bottle" by The Police, and a guy in a full yellow skin-tight bodysuit and mask dancing to Marilyn Manson's "Personal Jesus." Where before we allowed ourselves unmediated immersion with the screen, these videos force us to withdraw and resituate ourselves. How far do we let ourselves go? A video of three young girls copying Caroline's gawky, hyper-sexualised dancing say, "This is one we learned from you!" as they mimic a bend and snap. Worse than this explicit example of how quickly ideas of femininity and sexuality are shared and internalised are the videos which show a man masturbating to Ann's videos. The self-delusion involved in this man's commitment to his fantasy of Caroline forces us to step back, not only to review the hideous sexualisation and misogyny that leaks onto the Internet — but our own investment in our immaterial worlds.

As the comments pass in an endless stream, ranging from accusations of attention-seeking, to body shaming, to sexual harassment, you get an overwhelming sense of what an ugly place the Internet can be at times.

Twelve (2013) was the final piece on display and continues to unravel and question this distinction between on-screen and off-screen experiences. The piece simulates AOL dial-up and a chat room experience in the pre-broadband days. For the generation to whom iPads and instant wireless are a given, the use of iPads in this instance doesn't fully capture the embodied experience of those lumpy desktop computers. The chatroom experience itself, however, captures the moment perfectly. After the static squeaking of the dial-up, we land straight in a chat room. Navigating the different message windows, we navigate through the conversations of a bunch of tweens.

As someone who was once a 12 year old girl left to venture through the web from a boxy white desktop in my family living room, I find Hirsch's piece to be remarkably on point. Utilizing the idioms and half-innocence of the age group and technology, the IM conversation carefully conveys the balance between the excitement of acknowledgement and acceptance on the one hand, and the pervasion of flirtatiousness and sexuality on the other. As private messages pop up in and around the group chat, we explore more of this little-spoken-about experience. We stand witness to the insecurity, the vulnerability, and, most importantly, the definitive agency of the pre-teen girl. It's that combination which Hirsch has done well to capture and is important to recognize.

Like the rest of the pieces in the exhibition, *Twelve* lays bare inconvenient and awkward truths. Only in this piece, the viewer is taken with Ann, we are not asked to step outside and survey. It is only here in front of the iPad simulating dial-up that I paused to consider the mediums themselves: the stencil of the TV that first struck me, the four screens like windows on a computer, the chat room now gracing the iPad in front of me with retro-AOL aesthetics. Hirsch's work is a unique insight into the agency of young girls navigating these spaces. The pieces call into question the forces that sublimate sexuality, challenging the social forces that are enacted through these mediums and making them visible.

LIST Projects: Ann Hirsch

Ann Hirsch

Curated by Henriette Huldisch

MIT LIST Visual Arts Center

On display until February 21

MOVIE REVIEW

Moore's war of hearts and minds

Michael Moore's new documentary is persuasive and evasive in equal measure

Where to Invade Next

Directed by Michael Moore

Rated R

Now Playing

By Josh Cowls

The title of Michael Moore's latest documentary, *Where to Invade Next*, seems to reflect ambivalence on the part of its creator. It is after all no coincidence that Moore's trio of breakout box office hits — *Bowling for Columbine*, *Fahrenheit 9/11*, and *Sicko* — appeared during the administration of his antagonist-in-chief, George W. Bush. Though no one would pretend that mass shootings have subsided since the release of *Bowling for Columbine*, the election of President Obama saw the formal end of the Iraq War and the passing of health care reform — the subjects of *Fahrenheit 9/11* and *Sicko,* respectively. The working title of Moore's latest project might as well have been, *What To Tackle Next?*

The answer is a little complicated. The movie starts with spliced-together footage showcasing a litany of modern American sins — collapsing bridges, failing schools, tanks rolling through Ferguson — cleverly juxtaposed with voice-over rhetoric of American "nation-building" overseas. In response, Moore embarks on a global journey — albeit one which only covers three timezones, by my count — to "invade" other countries, talk to their citizens, and bring back their best policy ideas.

Moore's comedic conceit burns bright but fades fast. The light-hearted language of "invasion" and "surrender" in the scene-setting voiceover quickly becomes tired, as does Moore's insistence on "planting" an American flag in the home, office, or factory of each of his slightly bemused interviewees. In a narrative sense at least, the gimmick is effective in providing a unifying purpose to the disparate set of issues Moore's journey covers, from drug decriminalization to prison reform to childhood nutrition. Yet as an attempt to construct a coherent ideological platform, the approach is oddly à la carte; Moore's own stated intention to "pick the flowers, not the weeds" feels less like a mission statement than an (almost literal) admission of cherry-picking.

None of this is to detract from Moore's masterful skills as an interviewer: his talent for eliciting pitch-perfect responses with faux naiveté borders on ventriloquistic, even across language barriers. And while Moore's conversations may have been carefully curated, the idea of learning about a given policy by talking to people who benefit from it is certainly more persuasive and substantive than anything you're hearing right now on the presidential campaign trail.

Many of Moore's case studies, moreover, are genuinely enlightening, and some inspiring: a country with Norway's redemptive jails, France's gourmet school meals, and Slovenia's migrant-friendly universities would undoubtedly be a pleasant place to live. Yet of course, no such single country exists — and therein lies the central flaw of Moore's project.

His talent for eliciting pitch-perfect responses with faux naiveté borders on ventriloquistic, even across language barriers.

The picture Moore paints of an 'arc of equity' stretching across mainland Europe is as morally simplistic and factually faulty as his nemesis Bush's 'axis of evil;' the other side of the ledger is seldom examined. Italians enjoy their copious holiday pay probably more than the country's economists celebrate its tepid growth. French children enjoy their state school lunches even as the state extends its zealous secularism into personal expressions of faith. And even as Moore lauds its egalitarianism and progressivism, Europe remains stained with the twentieth century's nationalist and fascist excesses, which still lurk in the shadows.

This makes it all the more galling that Moore seldom ventures beyond the supposed social democratic havens of Europe to other parts of the world. Aside from a swift jaunt across the Mediterranean to Tunisia — and Moore is either unaware or unwilling to discuss the continent's sporadic, sclerotic response to the tide of migrants heading in the opposite direction — Moore doesn't once step foot on non-European soil. Rwanda, Brazil, and Iran each get a momentary stock-footage shout-out; nowhere else gets a look-in. It's an unfortunate oversight, especially since a geographically and culturally broader outlook would better inoculate Moore's argument against Europe's current strife.

Moore's Bush-era documentaries took a 'shock and awe' approach, fuelled by simmering resentment towards the belligerence of America's leadership, the gun violence enabled by its laws, and the sicknesses endured by its people. Moore should be lauded both for his broader ambition and his slightly lighter touch in *Where To Invade Next,* casting a wider net to take on a far larger and more diverse set of issues. But this approach requires the sort of nuance and balance that Moore, battle-hardened and single-minded, is ill-equipped to provide. *Where To Invade Next*, for this reason, is a mission far from accomplished.

TV REVIEW

The NYC record industry comes to life in '70s rock drama Vinyl

Producers Mick Jagger and Martin Scorcese strike the right chords

By Ray Wang

He's a record man. Snorting coke in his car, his personal life on the verge of collapse, wanted for questioning for murder, trying to escape. Escape everything.

That's how we meet Richie Finestra, the head of American Century Records — the record label that he built with his bare hands. But after failed signings and a reputation as the "American Cemetery, where artists go to die," the dying label is nearly sunk. It's hard to have sympathy for a man who, like the Wall Street banker he's mistaken for, can be ruthless to and heedless of his loved ones. But he's driven by his love of music, his loyalty to his label, and the art that formed him.

Finestra's gripping story lies at the heart of *Vinyl*, the new HBO series created by Mick Jagger, Martin Scorsese, Rich Cohen, and Terence Winter. Bobby Cannavale, of *Boardwalk Empire* fame, delivers another Emmy-worthy performance as he steps confidently into the role of Finestra, capturing his complexity.

Cannavale is backed by a capable cast — the underused Olivia Wilde as Finestra's wife; Ray Romano as Zak Yankovich, Finestra's right-hand man; and J.C. Mackenzie as Skip Fontaine, American Century's cunning head of sales.

Vinyl is best when it focuses on the music, as other critics have noted. One of the show's most powerful subplots is that of blues singer Lester Grimes (Ato Essandoh). His story, shown through flashbacks, is intertwined with Richie's and similarly fraught with turmoil.

We meet Lester in a bar, pouring his soul into his voice and his guitar, the stage lights silhouetting his face. Richie, at the time just a bartender, watches in awe. Richie offers to be Lester Grimes' manager, beginning Richie's ascent to fame.

In snippets, we learn how Richie rises in the music industry through Lester's success and starts his own record label, unwillingly but ruthlessly leaving Lester behind.

An unlikely star is Juno Temple, who plays the ambitious American Century assistant Jamie Vine. Vine's intent on making it in the record industry, and her strong-willed and spunky character may be Temple's breakout role. A fearless free spirit, Vine takes the punk-rock band The Nasty Bitz, led by Kip Stevens (James Jagger), under her wing, hoping to turn the raw group into the next great act.

The Nasty Bitz, themselves another major plot line, are introduced on a grungy stage spewing god-awful noise, turning the audience hostile and violent as Vine looks on with a crooked smile. It's this exact quality that Vine loves — the raw emotion and anger that the band emanates and elicits is something she's never seen before. The band connects us to the world they live in, much like *Vinyl* offers us a gritty glimpse of every echelon of the '70s. It was, surely, a wonderful time to be alive in New York.

Vinyl premiered on HBO on February 14.

Vinyl

Created by Mick Jagger, Martin Scorsese, Rich Cohen, and Terence Winter

Starring Bobby Cannavale, Ray Romano, and Olivia Wilde

On HBO

Ray Romano as Zak Yankovich in Vinyl. COURTESY OF HBO

Design constraints lead admins to axe plans for dormitory

Initial goal was to house students in the renovated building by 2018

Metropolitan, from Page 1

"Certain unforeseen design constraints and construction challenges associated with renovating a 100-plus-year-old building on the National Register of Historic Places now make our estimated timeline difficult to achieve," Gleason told *The Tech* in an email. "There is also a multi-step permit approval process that is likely to push the original completion schedule beyond 2018."

At several points, students were able to give input on the design of the dorm that would have been built in the Metropolitan building.

"Students on the Met Warehouse Advisory Group and the Chancellor's Student Housing Advisory Committee provided valuable insights throughout the design process," Gleason said. "Their input, along with the input collected during [dorm presentations], led to important changes in proposed room sizes and floor layouts as well as aspects of the dining, maker, and community spaces envisioned for a Met undergraduate residence hall."

"On more than one occasion, the team completely reworked floorplans based on our input. The design, in its final iteration, reflected a sincere respect for students' opinion and insight into their own living spaces," DormCon President Yonadav Shavit '16, who serves on Metropolitan Warehouse Advisory Committee, said in a statement that was approved by the Chancellor's office.

"I am happy that the Metropolitan Warehouse will be used for something else; no matter how well the design process went, there was only so much we could do to turn the warehouse into a home," he said. "I believe that in this next dorm's design phase, informed by our recent discussions but no longer constrained by architecture, we can build a really great dorm."

Solution to Big Techdoku

from page 6

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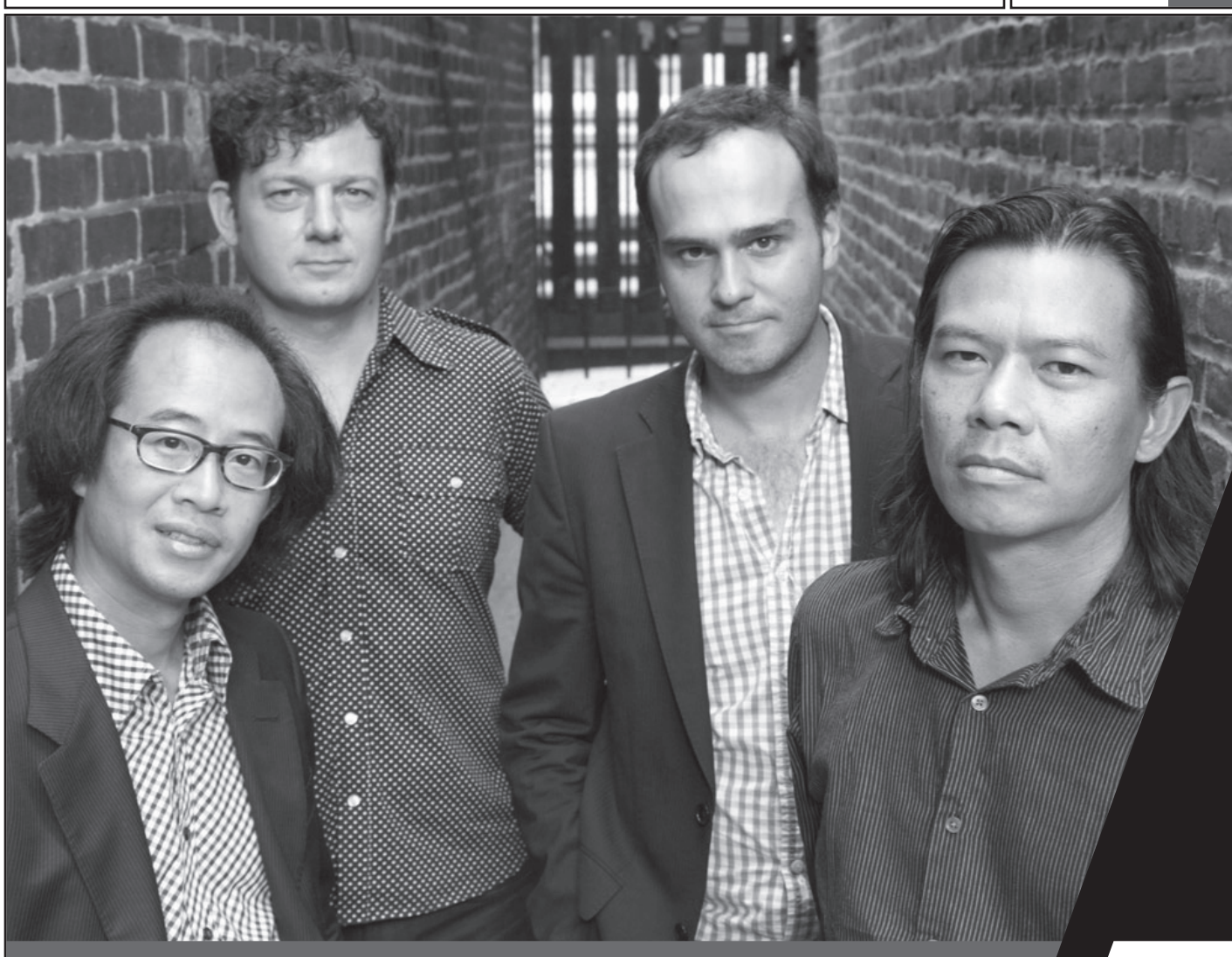


Privacy advocates fear that, if carried through, ruling could make access to private data easier

In letter to customers, Cook warns that the court order would require Apple to create a 'backdoor' for its own encryption software, weakening protections, making users unsafe

Apple, from Page 1

With the FBI's inability to get into the phone used by Syed Rizwan Farook, who was killed by the police along with his wife after they attacked Farook's co-workers at a holiday gathering, "the worst case scenario has come true," said Reynaldo Tariche, an FBI agent on Long Island who is president of the agents' association. "As more of these devices come to market, this touches all aspects of the cases that we're working on."

Magistrate Judge Sheri Pym of the U.S. District Court for the District of Central California issued her order after the FBI said it had been unable to access the data in the phone on its own and needed Apple's technical assistance to work around the encryption software protecting it.

Cook, the chief executive at Apple, responded with a blistering, 1,100-word letter to Apple customers, warning of the "chilling" breach of privacy posed by the government's demands. He maintained that the order would effectively require it to create a "backdoor" to get around its own safeguards, and Apple vowed to appeal the ruling by next week.

"The same engineers who built strong encryption into the iPhone to protect our users would, ironically, be ordered to weaken those protections and make our users less safe," Cook said.

Apple argues that the software the FBI wants it to create does not exist. But technologists say the company can do it.

Cook's angry tone reflected the tense discussions, conducted mostly on the telephone, between his company and the government's lawyers over the San Bernadino case.

Apple executives had hoped to resolve the impasse without having to rewrite their own encryption software, and they were frustrated by the Justice Department's refusal to file its demands under seal rather than airing them publicly in court, according to an industry executive with knowledge of the case, who spoke on condition of anonymity in discussing internal discussions.

The Justice Department and the FBI have the White House's "full support," the spokesman, Josh Earnest, said Wednesday.

His vote of confidence was significant because James Comey, the FBI director, has at times been at odds with the White House over his aggressive advocacy of tougher decryption requirements on technology companies. While Obama's national security team was sympathetic to Comey's position, others at the White House viewed legislation as potentially fraught. Late last year, Obama refused to back any legislation requiring decryption, leaving a court fight like the one playing out now with Apple as a likely situation.

The dispute could initiate legislation in Congress, with Republicans and Democrats alike criticizing Apple's stance on Wednesday and calling for tougher decryption requirements. Donald Trump, the Republican presidential contender, also attacked Apple on Fox News, asking: "Who do they think they are?"

But Apple had many defenders of its own among privacy and consumer advocates, who praised Cook for standing up to what they saw as government overreach.

Many of the company's defenders argued that the types of government surveillance operations exposed in 2013 by Edward Snowden, the former National Security Agency contractor, have prompted technology companies to build tougher encryption safeguards in their products because of the privacy demands of their customers.

"Apple deserves praise for standing up for its right to offer secure devices to all of its customers," said Alex Abdo, staff lawyer for the American Civil Liberties Union's privacy and technology section.

Privacy advocates and others said they worried that if the FBI succeeded in getting access to the software overriding Apple's encryption, it would create easy access for the government in many future investigations.

"This is not the last step in the journey," said Robert Cattanach, a former Justice Department lawyer who works on privacy and cybersecurity issues at the law firm of Dorsey & Whitney. "The next thing you know, they'll be in the back door of these systems."

The Apple order is a flashpoint in a dispute that has been building for more than a decade.

The FBI began sounding alarms years ago about technology that allowed people to exchange private messages protected by encryption so strong that government agents could not break it. In the fall 2010, at the behest of Robert S. Mueller III, the FBI director at the time, the Obama administration began work on a law that required technology companies to provide unencrypted data to the government.

Lawyers at the FBI and the Justice and Commerce departments drafted bills around the idea that technology companies in the Internet age should be bound by the same rules as phone companies, which were forced during the Clinton administration to build digital networks that government agents could tap.

The draft legislation would have covered app developers such as WhatsApp and large companies such as Google and Apple, according to current and former officials involved in the process.

Administration officials involved in drafting the legislation argued that, when armed with a court order, the government should able to get access to text messages and other data stored in plain text. Far less certain was whether the government could use a court order to force a company to write software or redesign its system was far less clear. A federal law would make that authority clear, they said.

But the disclosures of government surveillance by Snowden, the former National Security Agency employee and contractor, dramatically changed the privacy debate and the Obama administration decided not to go ahead with the proposed legislation. It has yet to be revived.

The legal issues raised by the judge's order are complicated. They involve statutory interpretation, rather than constitutional rights, and they could end up before the Supreme Court.

As Apple noted, the FBI, instead of asking Congress to pass legislation resolving the encryption fight, has proposed what appears to be a novel reading of the All Writs Act of 1789.

The law lets judges "issue all writs necessary or appropriate in aid of their respective jurisdictions and agreeable to the usages and principles of law."

The government says the law gives broad latitude to judges to require "third parties" to execute court orders. It has cited, among other cases, a 1977 ruling requiring phone companies to help set up a pen register, a device that records all numbers called from a particular phone line.

Apple, in turn, argues that the scope of the act has strict limits. In 2005, a federal magistrate judge rejected the argument that the law could be used to compel a telecommunications provider to allow real-time tracking of a cellphone without a search warrant.

PORTRAITS OF RESILIENCE

Mary Tellers

Editor's Note: Portraits of Resilience is a photography and narrative series by Prof. Daniel Jackson. Each installment consists of a portrait and a story, told in the subject's own words, of how they found resilience and meaning in their life.

I was always a happy kid. When I became a teenager, my sister ran away from home. She was still going to high school and I was the go-between. It just crushed my parents. That was the first time I felt depressed. When I was 18 or 19, this darkness came, and I knew it was something I was going to have to live with my whole life, and fight my whole life, and how much that sucked.

In March of my senior year in high school, I got a very bad sore throat. Eventually, my pediatrician just said you need to go to the ER and they need to figure out what's wrong with you. The nurse read my temperature, and it was 41 Celsius. She tried to convert it for me but it was off the charts. My mom is a nurse and she's the one that noticed that I started going septic because my legs went purple. I got put into the ICU. I had the Sacrament of the Sick, which is like the last rites.

I was delirious and so much in pain that I don't remember most of that time. It turned out that I had some thing called Lemierre's syndrome, which is a sore throat that turns into a blood clot that's septic and starts to break off. It wiped out most of the energy of my senior year. Everybody else was celebrating and I was just grateful that I was alive.

Going into college, I had this story to tell, because it was so formative. It made me really, really grateful about things. I still celebrate life day, which is the day I got out of the hospital. It's going on nine years.

My junior year of college, I studied abroad in Toulouse. While I was there, my dorm had a fire very early one morning. One half of the building was an inferno. Eventually they put the fire out. There were some pretty crazy rescues of people jumping off of the building. Then they got us into a cafeteria and told us that someone had died. It was really surreal to me how they said it in French, and you could hear all of the people who understood French gasp. And all of the people who didn't were looking around, like, what just happened? And then they said it in English. There was something to me about that gap. That's the feeling that I go back to. I always leave a building if there is a fire alarm, and I always send wishes of goodwill with fire trucks.

After I graduated college, I went to work for the Peace Corps in Guinea. One day, I was sitting next to a pool in this beautiful house that the country director owned. Suddenly there were footsteps and this man appeared, just like a tar-dipped skeleton. He ran at me, and tackled me to the ground. His arms were like a vise around me. My only thought was, "I'm not going to let this happen without fighting back," so I bit him. Anyway, it didn't work because biting someone's scalp is really ineffective and all I ended up with was a mouth full of sewagey hair. It was not good, but part of me is still proud of the fact that I fought back. Later we found out that he was being beaten by someone in his family and he was running away.

A week later, I had my first panic attack. Someone dressed in all black had come to shake my hand with both hands forward, which is a very respectful way to shake someone's hand. I couldn't see him well so I flinched. It was so rude of me, and I was beating myself up about it. I came back to my compound and found out down the road a semi-truck had hit a car and all seven people in the car had died. That was my running route, so for the next seven months I ran past this destroyed vehicle.

I tried to deal with it, to get a handle on the fragility of life, but things kept happening. I got a bad sore throat, and I thought, "I'm in a West African country with no health infrastructure and I'm going to die." I had a complete meltdown. It ended up being some weird infection. They put me on antibiotics and I got better.

From that day on I had PTSD. I was having nightmares every night, especially that there was someone in my room standing over me. In late May, a child was hit by a truck and my best Guinean friend said, "You should stay away," but I still think I saw body parts on the road. Two weeks after that happened, it was time to come home, because I was crying every day.

I didn't realize I had PTSD. I was working with the Army, and I went to a seminar on a virtual counselor they have for veterans with PTSD, and she was describing the questions it will ask you, like: Do you have nightmares? Do you ever feel like you're re-experiencing bad experiences? I was, like, check, check, check. I got this cold feeling that I was really sick and messed up.

I had started drinking way more than I ever drank before. Once I finally realized what was wrong with me, I said, you've got to stop drinking and you've got to get help. I read up on treatments. I got cognitive behavioral therapy, and antidepressants, which I felt shameful about, even though I knew, as a mental health advocate, medicine is not something to be ashamed about.

I imagined I was at the bottom of this dark pit and trying to scrabble my way up the sides. When I got on medicine, it was like someone said, "Here's a step stool." So I was still in the pit, but I was five feet closer to the top. I swallowed up any bit of pride that I had had, and took every bit of help I could get. Gradually I started getting better.

Anyway, when I came to MIT, I felt pretty good. I practiced changing my thought processes. Mostly I have this fear of cars. I just give myself five to ten seconds to make it through that scary period. If you're still good after that, then you're alive and it's okay. If they swerve and hit you, you're dead anyway, so what does it matter?

COURTESY OF DANIEL JACKSON

I think of PTSD as an injury rather than a mental illness. It's like my tennis elbow. Over the course of multiple traumatic events, I injured it. Now when I think it's going to get injured again, I protect it.

You have to believe that there's a light at the end of the tunnel. I'm not sure there is for everybody. PTSD isn't something that people always come out of, but I believed I could, and that may be why I'm doing so well right now. I might not be great forever, but if I am ever in that dark pit again, I have the tools to climb out.

Mary Tellers is a graduate student in the Department of Mechanical Engineering.

This project is supported by the Undergraduate Association's Committee on Student Support and Wellness, chaired by Tamar Weseley '17 and Alice Zielinski '16. To participate in the project, or to learn more, contact ResilienceProject@mit.edu.

There are many ways to find help. Members of the MIT community can access support resources at together.mit.edu. To access support through MIT Medical's Mental Health & Counseling Service, please call (617) 253-2916 or visit medical.mit.edu.

Love is...

Healthy relationships at MIT

Michal Shlapentokh-Rothman
STAFF WRITER

I never thought I would have to worry about healthy relationships. My relationships seemed pretty great. I have a close group of friends, two amazing parents, and a wonderful group of women that I get to call my sisters. It took one conversation to make me realize that while I don't have a directly unhealthy relationship myself, I certainly have felt the effects of one.

For the purposes of anonymity, I'll refer to the person in the unhealthy relationship as Alex. Alex was a close family friend I had known my whole life. Alex had always provided me with constant love and support, and I trusted them wholeheartedly.

Whenever Alex came home from break, they would always keep their door open. I used to randomly walk into their room and we would relax. But one day five years ago, when I walked up to Alex's room, the door was closed.

In my entire life, I had only seen Alex's door closed once: when their parents told them to be quiet because they were going to sleep. I thought Alex might have just been tired from school and was sleeping.

Except, I heard noise coming from Alex's room. Quickly, I figured out that Alex was Skyping someone. And that person was Alex's significant other.

The Skyping became more frequent. Alex became more distant and I rarely saw their door open anymore. Our conversations became superficial and, while I didn't realize it at the time, this was the first sign of the unhealthiness of the relationship. Even when Alex and their significant other moved in, they communicated 24/7.

> **Our conversations became superficial and, while I didn't realize it at the time, this was the first sign of the unhealthiness of the relationship.**

Overreliance on someone, a classic sign of an unhealthy relationship, was definitely there. Over time, more and more of the signs became apparent. When I stayed with Alex and their partner, I saw the aggression. Alex's significant other would constantly yell at them for the most trivial things. On their part, Alex tried to play it off and make it look like they weren't affected.

But when Alex went from easygoing to easily annoyed, I knew that they were not okay. On top of that, our conversations had become completely superficial. We would talk on the phone, but the conversation never lasted more than five minutes. A series of "hellos" and "how are yous" were exchanged, and then awkward silence. No laughing or smiling occurred. It became hard for us to talk to each other and the phone calls became less and less frequent.

Alex's relationship became increasingly dysfunctional, until it ended.

Now, Alex is trying to get back on their feet and recover from the relationship. We are talking more and I know that soon, Alex will be able to return to their normal self.

But I didn't write this to talk about my friend's bad relationship. I wrote it to bring awareness to the fact that unhealthy relationships are an unfortunate reality of life.

I could give you a list of the signs of unhealthy relationships, but at the end of the day, it comes down to one main thing: a change in the person. No matter how little or trivial it might seem, if something seems off about your friend, family member, or acquaintance, it's worth talking about. While Alex's relationship didn't involve physical abuse, many unhealthy relationships do.

The good news is that it is easy for people to become more aware of unhealthy relationships. It starts with spreading information and talking. TMAYD is a simple concept: ask your friends, family, and classmates how they are doing. And most importantly, if something is off, do not ignore it. Communicate with the people around you. It could really make a difference.

The more people know, the better off the world will be when it comes to preventing domestic violence. At MIT, we have several campus organizations that are invested in spreading the message of maintaining healthy relationships. My sorority, Alpha Chi Omega, recently held "Healthy Relationships Week." While the actual week might be over, the conversation about healthy relationships can and should continue year-round.

Lastly, never forget that one of the most important relationships you will ever have is with yourself. Self-esteem is essential for any relationship. Make sure that you are happy. Because you are important. At the end of the day, all the relationships in your life should all share one important quality: your happiness.

Physicists detect gravitational waves, confirming Einstein's general relativity

Signals measured from black hole collision conform to predictions

By Dennis Overbye
THE NEW YORK TIMES

A team of physicists who can now count themselves as astronomers announced Thursday that they had heard and recorded the sound of two black holes colliding 1 billion light-years away, a fleeting chirp that fulfilled the last prophecy of Albert Einstein's general theory of relativity.

That faint rising tone, physicists say, is the first direct evidence of gravitational waves, the ripples in the fabric of space-time that Einstein predicted a century ago. And it is a ringing (pun intended) confirmation of the nature of black holes, the bottomless gravitational pits from which not even light can escape, which were the most foreboding (and unwelcome) part of his theory.

More generally, it means that scientists have finally tapped into the deepest register of physical reality, where the weirdest and wildest implications of Einstein's universe become manifest.

Conveyed by these gravitational waves, an energy 50 times greater than that of all the stars in the universe put together vibrated a pair of L-shaped antennas in Washington state and Louisiana known as LIGO on Sept. 14.

If replicated by future experiments, that simple chirp, which rose to the note of middle C before abruptly stopping, seems destined to take its place among the great sound bites of science, ranking with Alexander Graham Bell's "Mr. Watson — come here" and Sputnik's first beeps from orbit.

"We are all over the moon and back," said Gabriela González of Louisiana State University, a spokeswoman for the LIGO Scientific Collaboration, short for Laser Interferometer Gravitational-Wave Observatory. "Einstein would be very happy, I think."

Members of the LIGO group, a worldwide team of scientists, along with scientists from a European team known as the Virgo Collaboration, published a report in Physical Review Letters on Thursday with more than 1,000 authors.

"I think this will be one of the major breakthroughs in physics for a long time," said Szabolcs Marka, a Columbia University professor who is one of the LIGO scientists.

"Everything else in astronomy is like the eye," he said, referring to the panoply of telescopes that have given stargazers access to more and more of the electromagnetic spectrum and the ability to peer deeper and deeper into space and time. "Finally, astronomy grew ears. We never had ears before."

The discovery is a great triumph for three physicists — Kip Thorne of the California Institute of Technology, Rainer Weiss of the Massachusetts Institute of Technology and Ronald Drever, formerly of Caltech and now retired in Scotland — who bet their careers on the dream of measuring the most ineffable of Einstein's notions.

"Until now, we scientists have only seen warped space-time when it's calm," Thorne said in an email. "It's as though we had only seen the ocean's surface on a calm day but had never seen it roiled in a storm, with crashing waves."

The black holes that LIGO observed created a storm "in which the flow of time speeded, then slowed, then speeded," he said. "A storm with space bending this way, then that."

The chirp is also sweet vindication for the National Science Foundation, which spent about $1.1 billion over more than 40 years to build a new hotline to nature, facing down criticism that sources of gravitational waves were not plentiful or loud enough to justify the cost.

Word of LIGO's success was met by hosannas in the scientific community, albeit with the requisite admonishments of the need for confirmation or replication.

When Einstein announced his theory in 1915, he rewrote the rules for space and time that had prevailed for more than 200 years, since the time of Newton, stipulating a static and fixed framework for the universe. Instead, Einstein said, matter and energy distort the geometry of the universe in the way a heavy sleeper causes a mattress to sag, producing the effect we call gravity.

A disturbance in the cosmos could cause space-time to stretch, collapse and even jiggle, like a mattress shaking when that sleeper rolls over, producing ripples of gravity: gravitational waves.

LIGO's antennas are L-shaped, with perpendicular arms 2.5 miles long. Inside each arm, cocooned in layers of steel and concrete, runs the world's largest bottle of nothing, a vacuum chamber a couple of feet wide containing 2.5 million gallons of empty space. At the end of each arm are mirrors hanging by glass threads, isolated from the bumps and shrieks of the environment better than any Rolls-Royce ever conceived.

Thus coddled, lasers can detect changes in the length of one of those arms as small as 0.0001 (one ten-thousandth) the diameter of a proton — a subatomic particle too small to be seen by even the most powerful microscopes — as a gravitational wave sweeps through.

Even with such extreme sensitivity, only the most massive and violent events out there would be loud enough to make the detectors ring. LIGO was designed to catch collisions of neutron stars, which can produce the violent flashes known as gamma ray bursts.

Black holes, the even-more-extreme remains of dead stars, could be expected to do the same, but nobody knew if they existed in pairs or how often they might collide. If they did, however, the waves from the collision would be far louder and lower pitched than those from neutron stars.

On Sept. 14, the system had barely finished being calibrated and was in what is called an engineering run at 4 a.m. when a loud signal came through at the Livingston site. "Data was streaming, and then 'bam,'" recalled David Reitze, a Caltech professor who is the director of the LIGO Laboratory, the group that built and runs the detectors.

Seven milliseconds later, the signal hit the Hanford site. LIGO scientists later determined that the likelihood of such signals landing simultaneously by pure chance was vanishingly small. Nobody was awake, but computers tagged the event.

Reitze was on a plane to Louisiana the next day. Weiss, on vacation in Maine, found out when he checked in by computer that morning. "It was waving hello," he said. "It was amazing. The signal was so big, I didn't believe it."

The frequency of the chirp was too low for neutron stars, the physicists knew. Detailed analysis of its form told a tale of Brobdingnagian activities in a far corner of the universe: The last waltz of a pair of black holes shockingly larger than astrophysicists had been expecting.

One of them was 36 times as massive as the sun, the other 29. As they approached the end, at half the speed of light, they were circling each other 250 times a second.

The ringing stopped as the two holes coalesced into a single black hole, a trapdoor in space with the equivalent mass of 62 suns. All in a fifth of a second, Earth time.

The signal conformed precisely to the predictions of general relativity for black holes as calculated in computer simulations, Reitze said.

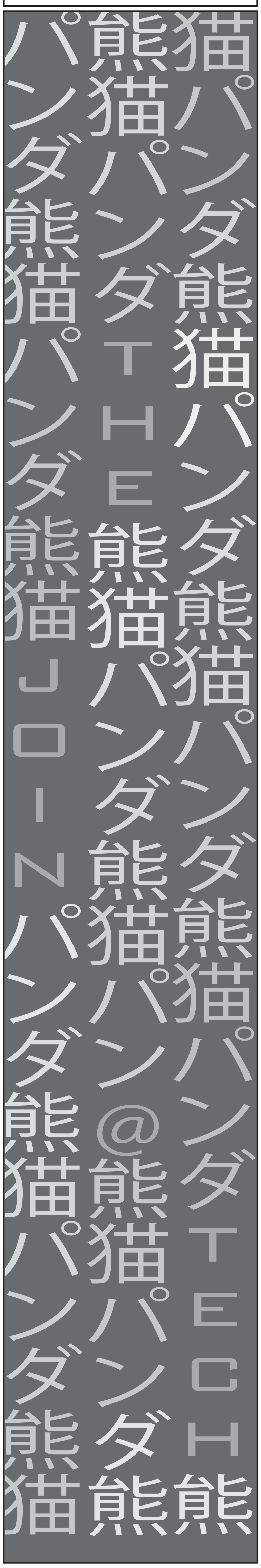
Shortly after the September event, LIGO recorded another, weaker signal that was probably also from black holes, the team said. According to Weiss, there were at least four detections during the first LIGO observing run, which ended in January. The second run will begin this summer.

In the fall, another detector, Advanced Virgo, operated by the European Gravitational Observatory in Italy, will start up. There are hopes for more in the future, in India and Japan.

Michael S. Turner, a cosmologist at the University of Chicago, noted that astronomers had once referred to the search for gravitational waves as an experiment, not an observatory. "LIGO has earned its 'O,'" he said. "That is, it will be an observatory, getting tens of events per year."

Turner added, "The loudest things in the gravity-wave sky are the most exotic things in the universe: black holes, neutron stars and the early universe."

The future for the dark side looks bright.



Solution to Sudoku I

from page 5

2	6	3	7	5	9	8	4	1
9	8	1	6	3	4	2	5	7
4	7	5	2	1	8	6	9	3
6	5	4	1	8	7	3	2	9
8	3	2	9	4	5	1	7	6
7	1	9	3	6	2	5	8	4
1	2	8	4	7	6	9	3	5
5	4	6	8	9	3	7	1	2
3	9	7	5	2	1	4	6	8

Solution to Sudoku II

from page 5

9	5	1	4	7	6	8	2	3
2	6	4	8	3	9	5	7	1
7	8	3	5	2	1	4	6	9
6	1	8	2	9	5	7	3	4
5	4	2	3	1	7	6	9	8
3	7	9	6	4	8	2	1	5
8	2	6	9	5	3	1	4	7
1	9	5	7	6	4	3	8	2
4	3	7	1	8	2	9	5	6

Solution to Techdoku I

from page 5

1	6	4	3	2	5
5	4	2	1	6	3
6	5	3	2	1	4
4	3	1	6	5	2
3	2	6	5	4	1
2	1	5	4	3	6

Solution to Techdoku II

from page 5

3	5	1	2	6	4
4	6	2	3	1	5
5	1	3	4	2	6
6	2	4	5	3	1
1	3	5	6	4	2
2	4	6	1	5	3

Solution to Saturday

from page 5

■	L	A	T	I	N	A	S	■	C	L	A	S	P	■
F	I	N	A	L	I	S	T	■	H	A	T	E	O	N
O	L	D	B	E	T	S	Y	■	I	N	T	A	K	E
G	A	O	L	■	S	I	L	K	■	D	I	N	E	S
S	C	R	E	W	■	S	E	A	S	■	C	A	R	T
■	■	■	S	E	M	I	■	Z	A	G	■	S	H	E
C	A	S	A	B	A	■	M	O	L	E	■	T	A	G
B	U	T	W	H	O	S	C	O	U	N	T	I	N	G
A	D	E	■	I	R	I	S	■	T	R	E	N	D	S
T	I	E	■	T	I	N	■	R	E	E	L	■	■	■
T	O	L	D	■	S	U	R	E	■	S	L	E	E	K
E	B	B	E	D	■	S	I	M	S	■	T	A	X	I
R	O	L	L	I	N	■	T	O	P	R	A	T	E	D
Y	O	U	A	R	E	■	E	T	A	I	L	E	R	S
■	K	E	Y	E	D	■	S	E	R	P	E	N	T	■

Two compete in Cyclo-cross Nationals

Van der Hoop's 5th place finish secures her a spot on the podium

COURTEST OF USA CYCLING

Julie van der Hoop competes at the Cyclo-cross Nationals at Asheville, N.C.

Souparno Ghosh
SPORTS EDITOR

Julie van der Hoop G and Corey Tucker G finished 5th and 22nd respectively, at the recently concluded Collegiate Cycling Cyclo-cross National Championship held at Asheville, North Carolina.

Cyclo-cross circuits are renowned for their treacherous terrains, steep slopes, and miscellaneous obstacles. The one at Asheville was touted to be a "devilishly difficult course full of punishing climbs, tricky off-camber turns and gnarly descents." Moreover, rain in the morning of the final race had made the course even more challenging, but as van der Hoop puts it, "That's one of the joys of cyclo-cross, though - everything and anything can change, but only sometimes to your advantage." As the race started, fatigue of a long, embattled season seemed to get the better of van der Hoop but she stepped up her game to reclaim fifth place in the final lap and secure a spot on the podium.

Finishing in the top five at the nationals was one of the goals, van der Hoop had set at the beginning of the season. The journey to a finish at the podium began with completing bike trails around Boston with the MIT cycling team. To get acclimated for racing conditions, cyclists would do mock-race training sessions at Larz Anderson Park in Jamaica Plain, hosted by the Back Bay Cycling Club.

To compete at the Nationals one needs to be an A-level racer in at least three races in the Eastern Collegiate Cycling Conference (ECCC). Julie van der Hoop, who finished as the series leader in the ECCC were joined by Tucker and Alex Springer '16 as MIT representatives in the cyclo-cross nationals.

For van der Hoop, who had been with the MIT cycling club since 2011, finishing at the podium was yet another cap in the feather in a season in which she had already finished as series leader and competed at the Canadian Nationals. For Tucker, who is a seasoned road-racer it was "a time to decompress and do some stupid fun stuff between road seasons."

Seven teams to play in final games

Last games of winter season to be played this weekend

Souparno Ghosh
SPORTS EDITOR

Brace yourself! It is the championship weekend for winter sports. MIT swimming and diving (men and women), track and field (men and women), fencing (men and women), and squash teams will battle for regional or conference titles starting February 18. Here we include a snapshot of what to expect and where you can catch all the action.

Fencing: The New England Intercollegiate Fencing Conference Championship will be held at Wellesley College on Saturday, February 20th. MIT women's team went 17-9 on the regular season and featured three All-Stars. Cordelia Avery '17 made the sabre first team to join captain Jessica Li '17 who made the foil first team. Rookie Helen Sakharova '19 was named to the epee second team. The men's team finished 10-14 overall record in the regular season. Benjamin Lin '17 and Tzer Wong '18 were both named to the Northeast Fencing Conference All-Star sabres first team.

Swimming and diving: MIT will host the New England Women's and Men's Athletic Conference (NEWMAC) swimming and diving championships from February 18-21.

The MIT men's team has posted a perfect regular season and will look to dominate at the weekend championships.

The women's team posted a 6-3 record along with a third place finish at the MIT Winter Invite. Veronika Jedryka '17, who holds the record for the fastest time in the 50, 100 and 200m Free for the Engineers in 2015-16, will look to add to her tally of NEWMAC championships following her two victories in 2015.

Track and Field: MIT will host the men's track and field New England Division III championship on February 19 and 20 while the women's team will be travelling to Middlebury College.

MIT women's track and field program is the highest rated division III program in the country. Maryann Gong '17 who ran NCAA Div. III top times for three straight weeks will be in action for the Engineers along with pole vault record-holder Cimran Virdi '16.

Men's relay team had their best effort (NCAA Div. III best for the season) last weekend at Boston University and will look to take that form into this weekend's championship.

Squash: The College Squash Association team nationals will be played at Yale University from February 19-21. MIT went 17-7 during the regular season that included a program-high 9-game unbeaten run.