Barry Rothberg
Naval Research Laboratory
Mergers of Galaxies

Abstract:

The sky at night appears to our naked eyes as a nearly unchanging, tranquil realm, broken only by the slow motions of the planets, the occasional passage of a comet, or the brief meteor shower. However, the universe is a far more tumultuous than our unaided eyes reveal. Galaxy collisions and the nascent systems created from these complicated encounters form the basis for our current cosmological paradigm. These seemingly exotic systems have puzzled astronomers since before the time of Edwin Hubble and before we fully understood that they were outside the realm of our own Milky Way. I will discuss a brief history of the merger phenomenon, from early observations and theories, to the seminal "Toomre Hypothesis," which forms the basis of our current understanding of galaxy evolution. I will also discuss recent work and controversies which question not only our understanding of the very basic properties of galaxy mergers, but which may raise doubts about our current understanding of cosmology.

Biography:

Barry Rothberg is currently a National Research Council Postdoctoral Fellow at the Naval Research Laboratory (NRL) in Washington, D.C. Before joining NRL, he was a Postdoctoral Fellow at the Space Telescope Science Institute in Baltimore, MD. His current research focus is on the properties of interacting and colliding galaxies, with a particular interest in their dynamics, the formation of new stars and identifying the properties of different stellar populations. He has worked on a variety of astronomical projects, including radio and x-ray properties of the sun, calibrating the distances to local galaxies in the near-infrared, and the properties of Globular Clusters in massive elliptical galaxies. Barry received his Ph.D. in Astronomy from the University of Hawai‘i at Manoa (2005) where he had the opportunity to observe with nearly all of the different telescopes on the summit of Mauna Kea. He received his Bachelors of Science in Astrophysics in 1997 from Tufts University.
Saving the Planetarium via Social Media

Raphael Perrino
Friends of Arlington’s David M. Brown Planetarium

“Growing up attending Arlington Public Schools (Randolph, Jefferson, W-L), I can earnestly say the Planetarium has had a significant impact on my life. As someone with a career in Earth Science, I have fond memories of the demonstrations I experienced at the Planetarium and how they guided my future. The Planetarium was my first meaningful introduction to worlds beyond our own.” – Sargon de Jesus

“As a professional astronomer and educational outreach participant, I have seen and experienced the impression made by a visit to a planetarium. In fact, I was so impressed by my first visit—to the Arlington Planetarium in 1972—it helped determine the course of my professional life.” – Dr. Alice Monet

“My 8-year old daughter, as a direct result of her wonderful experiences at the planetarium, has decided she wants to be an astronaut.” – Stephen Carrig

For 40 years, the David M. Brown Planetarium in Arlington, VA has inspired and educated thousands of children to pursue, teach, and admire the earth and space sciences. Nonetheless, Arlington Public Schools’ Superintendent proposed closing the planetarium early this year.

A motley group of locals decided to make noise. We were a former CFO, an economist, a science teacher, an MBA, a software engineer, and a technical communicator. Through our special niches, we ignited a firestorm. Before we knew it, we were the primary organizers for a cause responsible for uniting generations: It took on a life of its own.

We sent hundreds of e-mails and letters to elected officials and networks of science educators and civic associations. We distributed flyers on street corners and outside grocery stores. But many think it was the online effort that created the tipping point.

I started the SavePlanetarium social media campaign to spread the word quickly and gather stories from planetarium supporters. I drew from my experience as a technical communicator, and sought out or studied the work of social media experts, graphic designers, and Web designers for guidance. Let me describe the four-part strategy I used to define the digital front lines of the struggle to save the planetarium.

1. Multiple Tools for Different Audiences and Goals

SavePlanetarium began on Facebook and an online petition. Our audience included students, teachers, parents, planetarium visitors, astronomy enthusiasts, amateur and professional astronomers, and administrators. The initial goal was to broadcast that the planetarium would be closing within weeks. Once the Arlington School Board voted to keep the planetarium open during FY2010-11, SavePlanetarium shifted to a fundraising campaign under a newly formed organization, Friends of Arlington’s David M. Brown Planetarium.

Continued on Page 3
Continued from Page 2

The project became larger. I teamed up with Ryan Hanna, a social media expert. He created @saveplanetarium on Twitter, I built our website, www.saveplanetarium.org, and we co-administered the Facebook page. The website has a blog element that is an excellent medium for posting in-depth content; Facebook is the optimal tool for shorter messages, varied content and community interaction; and Twitter can quickly spread a short message to a large number of people.

2. Echo Content, Brand, and Message

I started looking for an effective logo and message. As the campaign expanded and evolved, SavePlanetarium would need to maintain a consistent brand across all social media tools. For example, a supporter visiting our website and Facebook pages should know both were part of the same organization. Content posted to the website echoed the Facebook and Twitter pages. Our Facebook, Twitter, and website visitors all received updates.
3. Post Engaging and Relevant Content, Frequently

One of the most critical elements of social media is engaging, frequent posts and relevant content. There have been days in the campaign when I’ve had 10 things I want to communicate to supporters, but had to select 1-2 of the most interesting updates: Don’t inundate supporters with posts, but keep them tuned into what’s happening. On slower days, I’d sometimes post recent discoveries in astronomy and astrophysics to engage the astronomy enthusiasts in the SavePlanetarium community. The key has been balance and timing.

If I wanted to reach the maximum number of supporters, I aimed to post during times of high traffic: Weekdays at 9 a.m., noon, and 8 p.m.

Continued on Page 5
Cont from p.4.

4. Create Sense of Community

In a social media environment, user feedback is everything. When nobody responds after posting to a 4,000-member Facebook fan page during a high traffic time, I need to re-evaluate my posts. If five users respond to a post, one of us needs to reply quickly. With the help of campaign members, we have used social media tools to encourage users to share stories, join the campaign, and spread the word.

The SavePlanetarium social media campaign is part of Friends of Arlington’s David M. Brown Planetarium, a non-profit organization dedicated to raising funds to keep the David M. Brown Planetarium open. Friends of the Planetarium is doing a tremendous amount of work on the ground, and the SavePlanetarium social media campaign has played an integral role in publicizing, documenting, and coordinating those on-the-ground efforts. But despite the collective enthusiasm of thousands who have helped to breathe life back into this Arlingtonian gem of science communication, the ultimate test of this campaign will be whether the doors of the David M. Brown Planetarium remain open in June 2011. We need your support!

Website: www.SavePlanetarium.org Facebook: http://bit.ly/Facebook-planetarium Twitter: @saveplanetarium

Raphael Perrino Board Member, Online Lead Friends of Arlington’s David M. Brown Planetarium rperrino@gmail.com

Mid-Atlantic Occultations and Expeditions

Dr. David Dunham

Asteroidal Occultations

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>EDT</th>
<th>Star</th>
<th>Mag.</th>
<th>Asteroid</th>
<th>dmag</th>
<th>s &quot;</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep 11</td>
<td>Sat</td>
<td>1:54</td>
<td>2UC43061589</td>
<td>11.4</td>
<td>Diana</td>
<td>1.7</td>
<td>7 7</td>
<td>TN, eKY, eOH, wPA</td>
</tr>
<tr>
<td>Sep 11</td>
<td>Sat</td>
<td>4:37</td>
<td>2UC39819169</td>
<td>13.0</td>
<td>Lipperzta</td>
<td>2.1</td>
<td>6 10</td>
<td>WV, nVA, MD, sePA</td>
</tr>
<tr>
<td>Sep 20</td>
<td>Mon</td>
<td>3:53</td>
<td>2UC40675313</td>
<td>12.5</td>
<td>Maicy</td>
<td>1.8</td>
<td>3 8</td>
<td>eTN, wOCVA, SM, DE</td>
</tr>
<tr>
<td>Sep 23</td>
<td>Thu</td>
<td>2:44</td>
<td>TYC23161541</td>
<td>11.4</td>
<td>Maria</td>
<td>2.2</td>
<td>6 7</td>
<td>seOCVA, wCV, eOH</td>
</tr>
<tr>
<td>Sep 25</td>
<td>Sat</td>
<td>4:38</td>
<td>2UC41338574</td>
<td>13.5</td>
<td>Vatican</td>
<td>1.0</td>
<td>6 10</td>
<td>VA, MD, DE, NJ</td>
</tr>
<tr>
<td>Oct  1</td>
<td>Fri</td>
<td>21:58</td>
<td>TYC23311421</td>
<td>10.4</td>
<td>Honkasalo</td>
<td>4.3</td>
<td>7 5</td>
<td>sePA, MD, DC, VA, NC</td>
</tr>
<tr>
<td>Oct  3</td>
<td>Sun</td>
<td>4:48</td>
<td>TYC19300413</td>
<td>11.2</td>
<td>Evelyn</td>
<td>2.9</td>
<td>3 6</td>
<td>eOH, wVrPA, seNY</td>
</tr>
<tr>
<td>Oct  7</td>
<td>Thu</td>
<td>4:27</td>
<td>TYC23870186</td>
<td>9.7</td>
<td>Brunhild</td>
<td>3.4</td>
<td>8 4</td>
<td>eVA, DC, eMD, DE, NJ</td>
</tr>
</tbody>
</table>

Lunar Grazing Occultations (*, Dunham plans no expedition)

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>EDT</th>
<th>Star</th>
<th>Mag.</th>
<th>%  alt</th>
<th>CA</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep 26</td>
<td>Sun</td>
<td>5:22</td>
<td>SC 317</td>
<td>6.4</td>
<td>92- 52</td>
<td>7S</td>
<td>*Charlottesville, Pt. AP Hill, VA</td>
</tr>
<tr>
<td>Oct  4</td>
<td>Mon</td>
<td>4:35</td>
<td>SAO 117823</td>
<td>9.0</td>
<td>16- 14</td>
<td>58</td>
<td>York &amp; Philadelphia, PA</td>
</tr>
<tr>
<td>Oct  4</td>
<td>Mon</td>
<td>5:14</td>
<td>SAO 117833</td>
<td>8.9</td>
<td>16- 21</td>
<td>7S</td>
<td>Rockville &amp; s, Laurel, MD</td>
</tr>
<tr>
<td>Oct  4</td>
<td>Mon</td>
<td>5:33</td>
<td>SAO 117843</td>
<td>8.5</td>
<td>16- 24</td>
<td>8S</td>
<td>*Millersburg &amp; Quakertown, PA</td>
</tr>
</tbody>
</table>

Total Lunar Occultations

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>EDT</th>
<th>Ph</th>
<th>Star</th>
<th>Mag.</th>
<th>%  alt</th>
<th>CA</th>
<th>Sp. Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep 13</td>
<td>Mon</td>
<td>21:31</td>
<td>D</td>
<td>SAO 184277</td>
<td>7.9</td>
<td>37+ 8</td>
<td>62S</td>
<td>B8 Az. 228, close?</td>
</tr>
<tr>
<td>Sep 14</td>
<td>Mon</td>
<td>20:17</td>
<td>D</td>
<td>SAO 185134</td>
<td>7.8</td>
<td>47+ 22</td>
<td>56S</td>
<td>A0</td>
</tr>
<tr>
<td>Sep 14</td>
<td>Mon</td>
<td>20:45</td>
<td>D</td>
<td>ZC 2469</td>
<td>6.5</td>
<td>48+ 20</td>
<td>12N</td>
<td>A0</td>
</tr>
<tr>
<td>Sep 14</td>
<td>Mon</td>
<td>22:43</td>
<td>D</td>
<td>SC 2483</td>
<td>7.1</td>
<td>48+ 6</td>
<td>68N</td>
<td>K1 Az. 231</td>
</tr>
<tr>
<td>Sep 16</td>
<td>Thu</td>
<td>19:44</td>
<td>D</td>
<td>SAO 187581</td>
<td>7.8</td>
<td>67+ 27</td>
<td>49S</td>
<td>G8 Sun alt. -7</td>
</tr>
<tr>
<td>Sep 16</td>
<td>Thu</td>
<td>21:39</td>
<td>D</td>
<td>D 2777</td>
<td>6.9</td>
<td>68+ 26</td>
<td>80S</td>
<td>A0 mg2 8.5 sep. 8&quot;</td>
</tr>
<tr>
<td>Oct  1</td>
<td>Fri</td>
<td>21:58</td>
<td>D</td>
<td>TYC23311421</td>
<td>10.4</td>
<td>Honkasalo</td>
<td>4.3</td>
<td>7 5</td>
</tr>
<tr>
<td>Oct  3</td>
<td>Sun</td>
<td>4:48</td>
<td>D</td>
<td>TYC19300413</td>
<td>11.2</td>
<td>Evelyn</td>
<td>2.9</td>
<td>3 6</td>
</tr>
<tr>
<td>Oct  7</td>
<td>Thu</td>
<td>4:27</td>
<td>D</td>
<td>TYC23870186</td>
<td>9.7</td>
<td>Brunhild</td>
<td>3.4</td>
<td>8 4</td>
</tr>
</tbody>
</table>

Explanations & more information are at http://iota.jhuapl.edu/exped.htm.

David Dunham, dunham@starpower.net

Phones: home 301-220-0415; cell 301-526-5590

Timing equipment and even telescopes can be loaned for most expeditions that we actually undertake; we are always shortest of observers who can fit these events into their schedules, so we hope that you might be able to.

Information on timing occultations is at: http://iota.jhuapl.edu/timing920.htm.

Good luck with your observations.
Distant Planet
Credit: David Lafrenière et al.

Now that's a lonely planet! Astronomers have discovered a world orbiting its star from 50-billion-kilometers away—or nearly 10 times farther out than Pluto is. The planet is following an orbit that takes about 6000 years to complete. How did such a large body form so far away from its sun? Astronomers say the same cloud of dust and gas that gave birth to the star—known as 1RXS J160929.1-210524 and located about 450 light-years away in the constellation Scorpius—probably split apart, which is what often happens when binary star systems are born. Except that in this case, the fragment was too small to produce anything but a very large, very cold, and extremely isolated planet.

Galaxy Tail
From June 2010
Astrophysical Journal Letters

IC 3418 has a secret. At first glance, it looks like any other spiral/elliptical galaxy but in ultraviolet light, IC 3418 has a tail—one that’s filled with thousands of young stars. The galaxy is located about 54 million light-years away in the middle of the immense Virgo cluster—a collection of about 1500 closely packed galaxies. So closely packed, in fact, that Virgo’s gravitational tug is pulling IC 3418 through its heart at 3.6 million kilometers an hour, ripping away huge amounts of gas and trailing it behind. The galaxy has been whipped up so much by its encounter with the intergalactic medium—like a comet’s tail of ice crystals getting buffeted by the solar wind—that it has condensed into stars.

Evaporating Exoplanet
Credit: C. CARREAU/ESA

First detected in 2008, WASP-12b is a planet with a mass 1.4 times that of Jupiter. Unlike Jupiter, though, it orbits very close to its parent star—so close that its period is only 26 hours. Thus, WASP12-b is subject to intense tidal forces and is one of the hottest and most intensely irradiated planets known. To understand the consequences of such close stellar proximity, Fossati et al. observed WASP-12b with the Cosmic Origins Spectrograph recently installed on the Hubble Space Telescope. Analysis of the near-ultraviolet part of the planet's transmission spectrum shows that WASP-12b is surrounded by an extended layer that absorbs light at the wavelengths of neutral sodium, tin, and manganese, as well as singly ionized ytterbium, scandium, manganese, aluminum, vanadium, and magnesium. This layer extends as far as 2.69 times the radius of Jupiter, well beyond the distance within which orbiting material is gravitationally bound to the planet; thus, as previously predicted, the planet is actively losing material to the star. Giant planets, like the ones in our solar system, are not expected to have elements other than hydrogen and helium in their upper atmospheres because there is little vertical mixing. To have such a metal-rich exosphere, WASP-12b must have suffered extreme mixing, possibly induced by the intense stellar irradiation and tidal effects.

Is Our Solar System Still Making Moons?
by Phil Berardelli on June 9, 2010 in Science Now

New simulations suggest that seven of Saturn’s moons were formed as recently as 10 million years ago—over 4 billion years later than the 55 other major bodies orbiting the planet. Researchers think even more new moons could be in prospect because the processes that produced the most recent examples are still active.

Seven tiny moons of Saturn are peanut-shaped like asteroids, suggesting that they formed at the beginning of the solar system and were grabbed by Saturn's gravity. But Cassini's instruments discovered that the density of the ring moons was closer to that of Swiss cheese than asteroid rock: less than 1 gram per cubic centimeter. That difference means that unlike the sun, planets, and other moons in the solar system, the ring moons didn't condense from a huge primordial disk of gas and dust. So how were they born?

The most obvious answer is that material from Saturn's rings clumped to produce the moons, but no one could develop a coherent computer model that mimicked the process. Now a team of researchers has done exactly that. By combining and adapting computer models designed to simulate solar-system formation and the orbital migration of planets, the researchers were able to show that the seven moons could condense directly from the rings and retain their wispy consistency.

The gravitational interactions of ring material beyond the Roche limit made the formation of aggregates unavoidable. As the simulation proceeded it produced mergers among the aggregates, which yielded increasingly bigger objects. And soon, tiny moons "just like Pandora and Epimetheus appeared."
Star Dust Speaker Reviews

By Michael Chesnes

I warmly encourage NCA members to write reviews for the talks at our meetings, so that they can be published in Star Dust. We have an excellent lineup of speakers every year, and our reviews are both a valuable historical record of our activities and a way to recognize our speakers.

Calendar of Events

NCA Mirror- and Telescope-making Classes: Tuesdays Sept. 7, 14, 21, 28 and Fridays, Sept. 3, 10, 17, 24, 6:30 to 9:30 pm at the Chevy Chase Community Center, at the northeast corner of the intersection of McKinley Street and Connecticut Avenue, N.W. Contact instructor Guy Brandenburg at 202-635-1860 or email him at gfbrandenburg@yahoo.com. In case there is snow, call 202-282-2204 to see if the CCCC is open.

Open house talks and observing at the University of Maryland Observatory in College Park on the 5th and 20th of every month at 8:00 pm (Nov-Apr) or 9:00 pm (May-Oct). There is telescope viewing afterward if the sky is clear.

Dinner: Saturday, June 12 at 5:30 pm, preceding the meeting, at the Garden Restaurant in the University of Maryland University College Inn and Conference Center.

Upcoming NCA Meetings at the University of Maryland Observatory

- Sep 11, 2010  Barry Rothberg (NRL) - Mergers of Galaxies
- Oct 9, 2010  Joseph Weingartner (GMU) - The Dusty Universe
- Nov 13, 2010  Tamara Bogadanović (UMd) - Black Holes: Alignment of Spins, and Light from Mergers
- Dec 11, 2010  Scott Sheppard (DTM) - Satellites of the Giant Planets

Yes, I'd like to join NATIONAL CAPITAL ASTRONOMERS!

Name: ............................................................................................................ Date: _____/_____/______
Street address: ..........................................................................................................................
City/State/ZIP: ..........................................................................................................................
Telephone: _____ - _____ - _______ E-mail: ..........................................................
Would you prefer to get Star Dust by e-mail? __________

MEMBERSHIP CATEGORIES AND ANNUAL DUES RATES

All members receive Star Dust, the monthly newsletter announcing NCA activities. The basic dues cover an electronic copy of Star Dust; paper copies are $10 extra. You may also choose to get Sky & Telescope magazine at the discounted rate of $33.

Student Membership ........................................ $ 5
Paper copy of Star Dust ............................................... $10
Sky & Telescope .......................................................... $33
Total ......................................................................

Individual/Family Membership ....................... $10
Paper copy of Star Dust ............................................... $10
Sky & Telescope .......................................................... $33
Total ......................................................................

Please mail this form with your check payable to National Capital Astronomers to:
Mr. Michael L. Brabanski, NCA Treasurer; 10610 Bucknell Drive, Silver Spring, MD 20902-4254
Inside This Issue

Next NCA Mtg:  
Sept. 11
7:30 pm @ UM Obs
Dr. Barry Rothberg

Preview of Sept. 2010 Talk.......1
Social Media..........................2
Occultations..........................5
Science News..........................6
Calendar................................7