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The Mathematics and Physics Institute NEWSLETTER

Director: Jennifer Snyder
Associate Director: Richard Delaware

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YEAR 17 – WE BEGIN

Currently 55 students are enrolled at the MPI, consisting of 1 student from Blue Springs, 1 from Blue Springs South, 3 from Center Place Restoration, 11 from Fort Osage, 1 from Lutheran, 7 from Northeast, 2 from Paseo, 1 from St. Mary's, 17 from Truman, 1 from Van Horn and 10 from Wm. Chrisman high schools. Of these 18 are female and 37 are male.

!! MPI OPEN HOUSE !!

Sunday, Nov. 5, from 1-3 p.m., the MPI will hold its annual **Open House** for parents, teachers, counselors, administrators, and anyone else interested in talking to the faculty, staff or students of the MPI. [The time has been changed from past years to allow everyone to get back home to watch the Kansas City Chiefs battle the Oakland Raiders at 3:15.]

We'll be in the Truman Campus Building of UMKC behind the Truman Library, just north off of Hwy. 24 in Independence. There will be:

- 1) Physics demonstrations and laboratory set-ups.
- 2) Mathematics demonstration problems on chalkboards with SHARP graphing calculators on display, and
- 3) the MPI Calculus Lab in Room 223 will be open with MPI student assistants ready to demonstrate mathematics software to our visitors.

In Room 207 at 1:30p.m., the MPI Director and Associate Director will make some brief remarks and introduce the MPI teachers. And of course, there will be refreshments. If you have any questions please call 235-1272. You're invited!

!! MPI OPEN HOUSE !!
SUNDAY, NOV. 5, 2000, 1-3 P.M.

SOME STATISTICS FROM OUR 99-00 ANNUAL REPORT

- 758 students have completed the MPI program (Years 1-16, Sept. 1984 – May 2000); 448 (59%) of these were male and 310 (41%) female.
- On average, 75% of all MPI students who start the program actually finish
- Of the 532 MPI Alumni from Years 1-11 (1984-95) (excluding foreign-exchange students), 496 (93%) entered college, receiving 365 college degrees (to the best of our knowledge), including at least 200 degrees in Science, Mathematics, or Engineering, 9 Medical Doctors, and 2 Ph.D.'s.

TO ALL MPI ALUMNI:

HAVE YOU GRADUATED FROM COLLEGE?

IF SO:
PLEASE CONSIDER BEING AN
-ENRICHMENT SPEAKER -

CALL 816-235-1272

Or E-MAIL
mpi@umkc.edu

MPI Alumni who have spoken:

Doug Bullock	(84-85)
Brent Harding	(84-85)
Pam Deters/Stephen Koop	(84-85)
Seth McMenemy	(88-89)
Tony Thornton	(88-89)
Mitch Dobson	(89-90)
Rachel Allen	(92-93)

■ Where 75% of MPI Alumni Go:

- 26% UMKC
- 15% UM-Columbia
- 11% UM-Rolla
- 5% Truman State Univ. (NEMSU)
- 4% University of Kansas
- 3% Central Missouri State University
- 3% Penn Valley Community College
- 3% Rockhurst
- 2% Northwest MO State University
- 1% William Jewell College

ODDS AND ENDS

For the next **three years**, Sheri Adams and Libbi Sparks will administer a Missouri Incentive Grant for Truman and Wm. Chrisman high schools, to improve student performance on the Missouri state assessment tests.

On **Sept. 8**, Richard Delaware gave a talk in the UMKC Dept. of Mathematics and Statistics Expository Talks series entitled "The Area of an Enigmatic Ellipse: Holditch's Theorem."

On **Oct. 6-7**, Richard Delaware will attend the 10th Annual Kansas City Regional Mathematics Technology EXPO at Rockhurst University in Kansas City, MO. He has been a member of the steering committee since 1991.

On **Oct. 27**, Richard Delaware will give a talk in the UMKC Dept. of Mathematics and Statistics Graduate Seminar series entitled "The Graph of a Convex Function in the Plane is the Countable Union of 1-Straight Sets."

ENRICHMENTS

FOLLOW UP

On Friday, **Sept. 22**, Lori Hill, an Electrical Engineer, former General Manager for Flight Safety Systems at Honeywell, and now Director of Broad Band at Sprint, spoke on **HIGH SPEED INTERNET**.

Students responded:

■ Lori opened with a bit about herself and a basic bit about her company. She worked as an engineer for Honeywell for several years. She next talked about new technology that is eventually going to cause current technology to become extinct. For

instance, pagers will be thrown out and cell phones will conquer all. Lori mainly brought us up-to-date on current technology and what we should expect for the future. She was very informative on a lot of the new gadgets that can be beneficial.

■ Now that long distance is pretty much free, Sprint is having to up its technology to small phones, I.D. rings, higher speeds, and many more. Math and physics is definitely needed in this area; in particular engineers. Lastly she explained code of conduct in business.

■ It was neat to hear about this stuff!

■ It was cool!

■ I thought it would be interesting to be able to have an interactive hands-on segment where we could see, touch and use some of the newest wireless communications devices, such as the palm pilots, the voice activated phones or even some of the products not released yet. Otherwise this was a very enlightening enrichment

■ I thought she did a very good job of presenting. She also spoke in terms we could understand, not confusing terms from her job that most would not understand.

■ I have been thinking about becoming an electrical engineer (Ms. Hill's major) and she showed me where I could take that degree and apply it to a job. I enjoyed it.

■ I think it was pretty good. I'm not terribly interested in all of this, but she did a good job.

■ Fascinating. The ideas and possibilities offered by advances in technology are really interesting. Ms. Hill is an excellent speaker. I thoroughly enjoyed this enrichment.

UPCOMING:

On Friday, **Oct. 6**, paleontologist and dinosaur hunter Craig Sundell of KU will speak on **THE REAL JURASSIC PARK: A WINDOW INTO PALEOECOLOGY**.

On **Oct. 20**, Ed Kiker, a Harvard graduate who majored in Lunar Geology, member of the National Space Society, and the CEO of Outer Space Industrial Resources Investigations Systems, will speak on **FLASHLINE: THE MARS ARCTIC RESEARCH STATION**.

On Nov. 3, Darrin Ingram, project manager and senior associate at Gould Evans Goodman Associates Architects, and member of the American Institute of Architects, will speak on **ARCHITECTURE: DESIGNING THE ENVIRONMENT.**

On Nov. 17, Carr Everbach of the Department of Engineering at Swarthmore College, who studies mechanisms by which ultrasound interacts with biological systems, will speak.

WE HEAR FROM PAST STUDENTS

C. Alan Canfield (86-87)
BS Mechanical Engineering
Test Engineer
Coastal Systems Station, Panama City, FL

E-mail received 9/12/00:

"I haven't seen many letters in the MPI Newsletter lately from early-year graduates, so I wanted to say "hello" and let you know we still appreciate receiving the newsletter. It is pleasing to hear, from the observations and recommendations of recent MPI graduates that the program has not lessened in rigor.

I offer [an] addendum to Physics Challenge #54 in Newsletter Vol. 15, No. 1. [See p. 5 of this issue.]

I am still in Panama City, Florida, where I have lived since shortly after graduating from MU. I recently accepted a position as a Test Engineer with the U.S. Navy Coastal Systems Station. Our mission is to develop and test near-shore mine warfare and countermeasure technologies.

I am active locally and state-wide in MATHCOUNTS, a national program sponsored by the National Society of Professional Engineers and others to challenge middle school students with individual and team math problem solving. I suspect that you see many MATHCOUNTS Alumni coming to MPI. Anyone that makes it through MPI would surely enjoy witnessing the excitement and talent of the "Mathletes."

Thank you and best wishes."

Patrick Liang (86-87)
M.D.

E-mail received 8/7/00:

"Hello from Central New York!! My wife and I have relocated to the Syracuse, NY area in preparation for my fellowship in Emergency Medicine, which begins August 15. I am returning to my first love of emergency medicine and will be here at the State University of New York (SUNY) Upstate Medical Center here in Syracuse.

This area is quite beautiful...large amounts of foliage, which display quite vibrant colors during the fall. Lots of hills and small mountains, all covered with grass and trees as far as you can see. Driving down the highways reveals lush valleys amidst these hills and most towns and farmsteads are built in these valleys. It is rather warm here, but certainly not as warm as it is in KC!! Winters here can be quite harsh...or so they tell me. My wife grew up an hour from here and can vouch for the winters that produce more than 120 inches of snow in one season. I am not looking forward to that!!

At any rate, tell Sheri Adams and Larry Harding hello for me!! Also, if you should talk with Al Morse, Calvin Nelson, and Richard Waring in the near future, greet them for me as well."

Daphne King (97-98)
(Civil Engineering Major)

E-mail received 4/21/00:

"MPI was very instrumental in my success the first few years of college. I just wanted to tell everyone thanks and keep up the good work, by preparing students for college."

Melinda Hacker (99-00)
(Mathematics Education Major)

E-mail received 8/30/99:

"This is Melinda Hacker and I just wanted to email you and begin contact between us. This year I am at Southwest Missouri State University, and I am majoring in mathematics education and minoring in French. This semester I am enrolled in Calculus II (at a late 8AM everyday—that's sleeping in compared to MPI) and NO PHYSICS! Yea! I look

forward to the panel discussion and reunion in January.”

impossible by any means. It’s really just another math and science course; just a little more work.”

Kit Dawson
Truman High School
Independence School District

MPI E-MAIL ADDRESS:

mpi@umkc.edu

A list of known MPI Alumni e-mail addresses is available upon request.

“When you first come to MPI, you may expect things to be overwhelmingly difficult. In some cases, you’re right; but for the most part, it isn’t too hard. The teachers make the lessons fairly easy to understand. However, make sure you have a patient lab partner or your labs will take longer to set up properly.”

Kurt Richter
Wm. Chrisman High School
Independence School District

2000-2001 STUDENT FIRST IMPRESSIONS

“I had trouble deciding to go to MPI because it conflicted with band. After careful consideration, I decided to go to MPI and drop band. Luckily, everything worked out and I am still in my school band and will soon be joining the Independence Community Band. I am very pleased that I made the decision to go to MPI. My first impressions of MPI have been generally positive, except for my Calculus homework on which I did horribly, but we won’t talk about that. I really like my teachers and the class material. I am somewhat worried that I will not end up with an A, which would greatly upset me and my GPA, but overall I think the program is wonderful and am glad I have had a chance to be a part of it. I hope that everyone else has had a wonderful beginning experience too.”

Laura Hajj
Ft. Osage High School
Ft. Osage School District

“Some of the teachers have found out that I didn’t do homework in all of my years of school and are determined to make up for it.....all in one week.”

Allison Scott
Center Place Restoration High School
Independence School District

“My first week at MPI was an exciting time for me because I knew it was going to be difficult. In the beginning I didn’t understand the material, but as I began to come to class more often, I began to understand a lot, especially the physics. Now that I have gotten used to the surroundings and teachings, I know it will be challenging and fun.”

Vy Pham
Northeast High School
Kansas City, MO School District

“For all of my past accomplishments in math and science and how easy all of my previous classes were, MPI was a shock. Not really because the subject matter or the speed of the class, but chiefly because of the expectations of the teachers and of myself. After getting into the flow, however, concepts of vectors and one-to-one functions came much easier. But it’s definitely a shock. It requires much more studying than I was used to, but it’s not

**A SOLUTION TO
MATHEMATICS CHALLENGE #64**

Recall the problem statement:

Three neighbors contributed \$4.00 each and bought a ham (without skin, fat, or bones). One of

them divided it into three parts asserting that the weights were equal. The second neighbor said she trusted only the scale at the local shop. There, it appeared that the parts, supposed to be equal, corresponded to the monetary values of \$3.00, \$4.00, and \$5.00, respectively. The third neighbor decided to weigh the parts on her home scale, which gave yet another different result. This led to a quarrel about who should get which part.

Explain how it is possible to settle this dispute and to distribute these three parts (without dividing them again) in such a way that each woman would have to admit that she had got at least \$4.00 worth of ham, if computed according to the scale which she trusted.

[From: One Hundred Problems in Elementary Mathematics, by Hugo Steinhaus, 1964, Dover, Problem #49, p.25.]

SOLUTION:

The dispute can be settled in the following way. Let the third neighbor choose first. She will of course choose the part which according to her home scale is not less than either of the remaining two pieces. That is the part whose value, in her opinion, is not less than \$4.00. Such a part must exist since by the division of the ham into three parts, at least one of the parts cannot be less than one-third of the whole weight.

Next, the second neighbor chooses her part. She must be satisfied because after the third neighbor took her part, there remained at least one part which according to the scale at the local shop corresponded to a value not less than one third of the whole weight.

Finally, the first neighbor, who receives the remaining part, must be satisfied since she considered all parts to be of equal weights.

A SOLUTION TO PHYSICS CHALLENGE #55

Recall the problem statement:

Since we are talking about coffee: As you stir instant cream or instant coffee (or Kool-aid!) into a cup of water, tap the side with your spoon. The

pitch of the tapping changes radically as the powder is added and then during the stirring. Why?

Tap the side of a glass of beer (but drink it only if you are over 21) as the head goes down. Again the pitch changes. Why?

You may have a tendency to answer that the foam or the powder dampen the oscillations caused by the tapping, but even if that is true, would that change the pitch or only the amplitude?

[Adapted from: Walker, J. (1977). *Flying Circus of Physics*. New York: Wiley & Sons, Inc.]

SOLUTION:

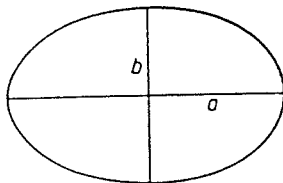
The answer has to do with the make-up of the instant cream or coffee and what happens as it dissolves. First, air is trapped into the powder that makes up the cream. As the powder dissolves, the trapped air is released. At this point, the coffee is primarily an air/water combination until all of the powder is dissolved and the air has escaped. During this time, the speed of sound in the air/water combination is lower than the speed of sound in just the water itself. So, as the powder dissolves, the speed of sound will be lower. The resonant frequency of the coffee depends on the speed of sound. So, the frequency will be lower as well until the air escapes.

ADDENDUM TO SOLUTION TO PHYSICS CHALLENGE #54, August 2000 Newsletter, offered by C. Alan Canfield (see p. 3 of this issue.):

Don't forget to take the spoon out of the coffee after stirring, if you want to maximize the heat retention time. The spoon acts as a heat exchanger to the environment, and can be modeled accurately as a flat-plate or circular vertical fin, depending on the spoon shape. I defer credit for this observation to Dr. Doug Hseih, retired professor at the University of Florida.

MATHEMATICS CHALLENGE #65

Suppose you are given an ellipse, as shown below, with major axis of length $2a$ and minor axis of length $2b$.



Draw another closed curve with exactly the same length as this given ellipse, but which encloses an area greater than the area of the ellipse by exactly $(a-b)^2$.

[From: One Hundred Problems in Elementary Mathematics, by Hugo Steinhaus, 1964, Dover, Problem #28, p. 18.]

PHYSICS CHALLENGE #56

This month's question is an estimating or order-of-magnitude question. That means that you should make estimates to answer the question and give your answer as an order of magnitude.

The question is: Approximately how many raindrops fall on a 1.0 acre lot during a 1.0 inch rainfall?

Editor/Writer:

Richard Delaware

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