



Signing off

“Bright lights” are a universal metaphor for the generic big city, but there are a few cities that are iconically associated with specific and highly recognizable bright lights. Times Square is the world-known symbol for New York City, as are the lights in Piccadilly Circus for London, and The Strip for Las Vegas. For most of the second half of the 20th century the light for these displays was generated by neon glowing in intricately formed glass tubes, and their particular hues, jerky animation, and flickering unreliability symbolized all that was simultaneously glamorous and tawdry about night life in the city.

Boston’s bright lights are different. In New York or London or Las Vegas, the best view of the lights is from the streets below, mingling with the crowds and craning your neck to look upward (or, even better, downward to see them reflected in rainy pavement). The iconic bright light in Boston, however, is the CITGO sign located near Kenmore Square, and it is set far too high up to be well seen from immediately below. The best views are from farther away, even from an airplane on approach to Logan Airport if you are lucky enough to fly in after dark and have a window seat on the proper side. It is a modern beacon for the city that was originally built around Beacon Hill. And while the bright lights in other cities advertise life’s frivolous pleasures—alcohol, soda, high-end watches, and electronics—Boston’s illuminated focus is on motor fuel. This is a city that retains the serious attitudes of its puritan roots, even to this day.

The CITGO Petroleum Corporation calls its logo the trimark, but any MRS member taking a break from the Fall Meeting and looking over toward the Fenway will see that a tetrahedron is clearly represented on the 60-foot wide sign. The tetrahedron,

after all, is an iconic shape for almost every branch of materials science. Some of us deal with oxygen tetrahedra, others with face-centered cubic metals and their stacking-fault tetrahedra (nicely described using the notation of Thompson’s tetrahedron). Some ply their trade with Berkovich indenters. We are all familiar with tetrahedral coordination of the diamond cubic lattice, and carbon and silicon atoms in general, and we describe almost all crystal structures in terms of tetrahedra of some sort. We even describe our discipline in terms of an imaginary tetrahedral knowledge-space with vertices representing structure, processing, properties, and performance. The tetrahedron is probably more prevalent in our work than any other single solid shape is in any other branch of science. I relate especially to the CITGO sign because it is double-sided, and a pair of back-to-back Thompson tetrahedra was the representation of a twin boundary that I used in one of my earliest research papers.

One person’s icon is easily enough adopted by another and, trademark issues notwithstanding, the CITGO sign might be taken by MRS members to represent materials science, at least for one week each year, during the Fall Meeting. Maybe if it were labeled like a Thompson tetrahedron, or had green spheres attached to its vertices, just for the week....





As appropriate as the CITGO sign is for the Fall Meeting, it was once even more so. When I first saw the sign in the late 1970s, it was formed from more than five miles of neon tubes and the white background and the red tetrahedron cycled on and off in a seemingly infinite number of combinations, probably because the different sections would go in and out of phase, working on their own mechanical switches, like some kind of byzantine structure factor calculation. Even more fascinating than these cycles, though, were the flaws caused by failed neon tubes. The dark lines were repaired regularly, but never completely eliminated. Every time I looked at it I saw vacancy clusters, or stacking faults, or maybe intercalation compounds, and just like vacancies in a real crystal, there seemed to be some kind of a steady state, if not actually an equilibrium concentration. You have to be a materials scientist to truly appreciate imperfections.

The sign was turned off in 1979 in a symbolic show of energy conservation, and returned to life in 1983 in response to pressure from the populace. It has survived many other near-death experiences but has always returned—arguably paralleling some parts of the discipline of materials science. In 2005, new technology born in the world's materials laboratories contributed to a major renovation and the sign was henceforth illuminated by light-emitting diodes instead of neon. Although the LEDs mimicked the lines of the previous neon tubes, gone were many of the flaws that had once fascinated me, and the infinitely varied cycling of the illumination was replaced with a single, much shorter, more predictable and less fascinating pattern. The sign has been dark once again this fall, during another renovation which includes a change to new, brighter, and more rugged LEDs, but it is scheduled to be back on line in time for the annual MRS invasion.

Please, oh please, when I check into the hotel for the Fall Meeting this year, give me a room with a view of the CITGO sign.

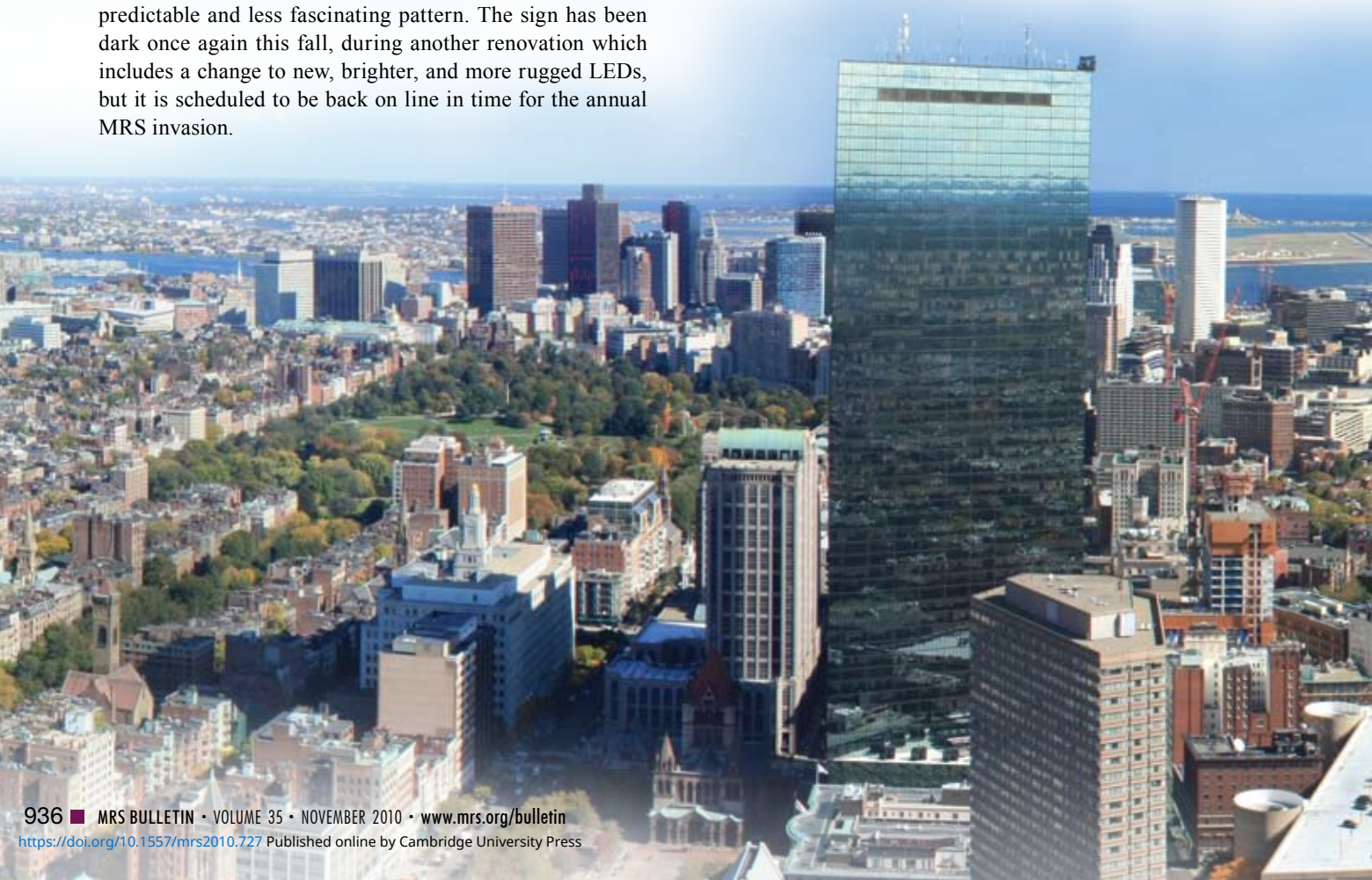
*Oh give me a view of the CITGO sign
The bed may be hard but still I won't mind
If the room is too tiny I won't become whiny
If I have a view of the CITGO sign*

*Oh let me look toward Kenmore Square
The faucets can drip but I still won't care
If I see the big sign then peace will be mine
When I look out west toward Kenmore Square*

*Just let me gaze upon Fenway Park
When the sign is fresh lit, and it's soon after dark
And if it should snow that will add to the glow
Of the sign overlooking old Fenway Park*

*For MRS folks the CITGO sign
Is a view that is truly quite sublime
It's a solid platonic and a symbol iconic
Of the things we discuss when we meet in the Hynes*

Alex King



"Asylum's customer service is paramount - I felt everyone there went the extra mile to make sure our AFM would be working at our new site. And all this occurred

"Your tech support staff has been great in helping us get the best possible data. They are definitely willing to go the extra mile. Asylum Support is Iconic! **BRYANT CHASE**

"The MFP-3D is a great system, easy to learn for a beginner and fantastic capabilities for an expert user. The system is continuously evolving as new and exciting features

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can also create Asylum MFP3D code in IGOR to suit our imaging and analytical needs." **RAJAY KUMAR, ETAMOTA CORPORATION**

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"The MFP has worked great for us. I've used (most other AFM brands) and have found the MFP to be superior for force measurements to all of them. The machine is extremely easy to learn how to use. I have undergrads working on it with no problem. The instrument support is fantastic as well." **CHRISTINE ORTIZ, MIT**

"Asylum's quality and reliability allow us to focus on the science."

DENNIS DISCHER, UNIV. OF PENNSYLVANIA



"We use A and prec knowled SONIA CO
"AR once a ERIC DARLING, BROWN UNIVERSITY

"We chose Asylum's MFP-3D-BIO AFM because it has the most powerful AFM capabilities of the inverted optical integrated systems - and we have not been disappointed. It excels in all aspects from optical integration to high-resolution imaging, 3D dimensional measurements to force spectroscopy, elasticity measurements of soft tissue matrices, also among the first few Asylum customers to purchase with the MFP-1D, and we still abuse it! Asylum's quality and reliability allow us to focus on the science." **DENNIS DISCHER, UNIVERSITY OF PENNSYLVANIA**

and the post-data collection processing capabilities are clearly superior. We are excited about applying the MFP-3D to our nanotoxicology research initially and to other

"The MFP-3D-BIO is a research instrument through and through and designed for the scientist. The optical integration is exceptional, and the flexibility of the platform offers almost endless possibilities." **JAN HOH, JOHNS HOPKINS UNIVERSITY**

"The MFP-3D...is superior for force measurements... and is extremely easy to learn how to use."

CHRISTINE ORTIZ, MIT



of instruments I chose the best of the most elegant and simple tool. Asylum Research is a striking factor in choosing the right AFM. For a new graduate university in a field where technical support can be very challenging, Asylum Research has shown a dynamic attitude in providing a solution for the needs of my laboratory." **MATTEO CHIESA, MASDAR INSTITUTE OF SCIENCE AND**

"Asylum (a talk direct barrier." **DAVID GINGER, UNIVERSITY OF WASHINGTON**

"I got early tenure because I use an Asylum AFM."

DAVID GINGER, UNIVERSITY OF WASHINGTON



added environmental control and have as a result a platform of exceptional precision. This versatile instrument has allowed us to efficiently perform

Asylum Research has shown a dynamic attitude in providing a solution for the needs of my laboratory." **MATTEO CHIESA, MASDAR INSTITUTE OF SCIENCE AND**

Seek Asylum for Your Next AFM

"Working having an additional AFM spectrom of our stum **MIKLOS KELLERMAYER, SEMMELWEIS UNIVERSITY**

UNIVERSITÉ DE NANCY

"I have to say, of all the instruments in my care, from FACS to multiphoton to laser tweezers to CT scanners to PCR machines to AFM, you are hands down the best when it comes to customer care and support! Thanks for all your help over the last couple years!" **CHRIS BJORNSSON, RENSSELAER POLYTECHNIC INSTITUTE**

"I spent five years as a post-doc using an MFP-3D, so when I started my own lab, I choose the best quality, versatile, outstanding our first AFM and the support customers into buying their products. Atomic Force was simply convinced us that the MFP-3D is the best AFM for our needs." **MARTIN BEYER, UNIVERSITY OF KIEL**

to get better). Mario Viani has been great, and I'm certain I could learn more physics from him in a week than I could from any other AFM. But that's not all. Asylum Research's customer support is exceptional. I've never had a problem with them that I couldn't solve. I'm sure that you might find the same level of support from them that I have. **KALININ, OAK RIDGE NATIONAL LABORATORY**

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"You are hands down the best when it comes to customer care and support!"

CHRIS BJORNSSON, RPI



"We've used the MFP-3D since 2002 and it has been an exceptional and flexible instrument. On the one hand, it's easy enough to use for training of students and, on the other, it is the most powerful AFM for high-resolution research projects. The open access software makes it easy to use a wide range of capabilities to enable your own research." **THOMAS GUTSMANN, LEIBNIZ-CENTER FOR ANIMAL BIOMIMETICS**

"Asylum support is amazing. You can talk directly to the scientists and engineers - there is no barrier."

JEREMY LEVY, UNIV. OF PITTSBURGH



"We wanted to thank you again for our successful installation. We enjoyed working with all the staff from Jean, as well as Rob's visit and information. It has been truly a pleasure working with Asylum Research and every time we contact you, you are helpful and excellent. We are looking forward to continuing working with you in the future. Hopefully we'll be placing another order before too long." **SANTIAGO SOLARES, UNIVERSITY OF MARYLAND**

We are really happy about our choice. The MFP AFM excels in all aspects, from topographical studies to force measurements. The MFP-3D is an instrument of great

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"I am very happy with my choice of AFM. Asylum's customer service is amazing. You can talk directly to the scientists and engineers - there is no barrier. Definitely if I want to buy another AFM it would be an Asylum." **JEREMY LEVY, UNIVERSITY OF PITTSBURGH**



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"Many companies say they provide great service and support, but consistently fail to do so. Asylum Research, on the other hand, proves every day how much we care about their customers by providing the best service and support in the industry. Truly exceptional." **SCOTT MACLAREN, UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN (UIUC)**

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"This must be the best warranty in the business."
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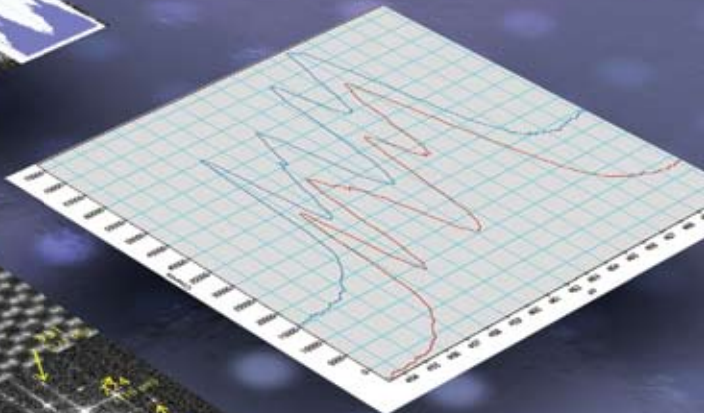
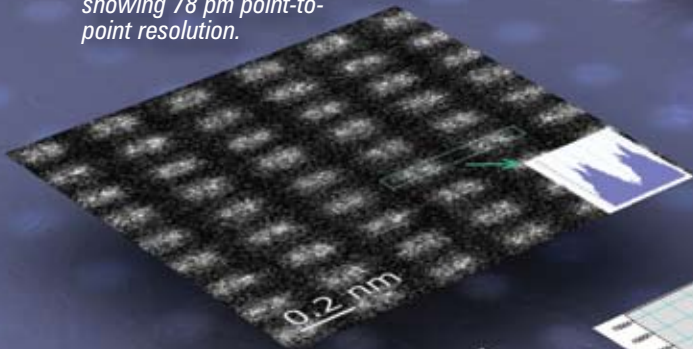
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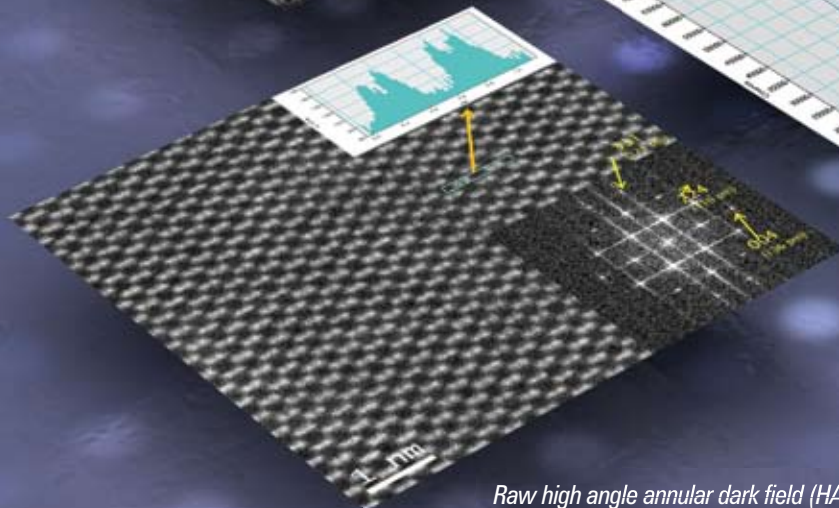
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Raw high angle annular darkfield (HAADF) STEM image of Si (112) showing 78 pm point-to-point resolution.



EELS spectra of rutile and anatase TiO_2 showing fine structure differences in the $Ti-L_{2,3}$ edge made visible by the low energy spread of Cold FEG.



Raw high angle annular dark field (HAADF) STEM image of Si (110) at 80 kV.

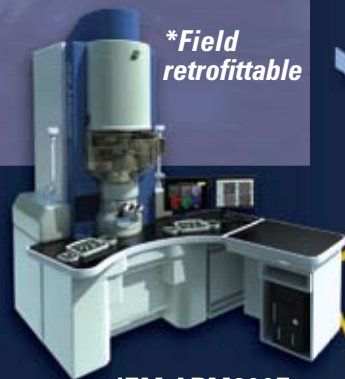
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