

Award Achievements

The Heinrich Rohrer Medal –Rising Medal–

Dr. Alfred J. Weymouth

"For his valuable contributions to force microscopy at the atomic scale including studying the interplay of current and force, applications of lateral force microscopy, and imaging in ambient conditions"

Dr. Weymouth made several significant contributions in the field of non-contact atomic force microscopy (nc-AFM). An important aspect of his work was the discovery of the so-called "phantom force". It is the influence of a tunneling current on the force on the AFM tip, which occurs on surfaces with relatively small conductivity. The current flow in the sample leads to a potential drop, affecting the electrostatic force sensitively measured by nc-AFM. While the atoms on a surface can appear repulsive due to the phantom force by applying the bias voltage (region I, bumps in the nc-AFM image), the expected attractive contrast be found when the tip come closer to the sample without bias voltage (region III, depressions in the nc-AFM image).

He had also applied lateral force microscopy to outstanding problems. One example is the characterization of a CO terminated tip, now used as a standard probe in nc-AFM experiments at low temperature, capable of resolving the internal structure of adsorbed organic molecules. The bending of the CO plays an essential role in enhancing the spatial resolution. Weymouth measured the interaction of a CO molecule attached to the tip apex with another CO molecule adsorbed on a Cu surface. He determined the lateral stiffness of the CO molecule on the tip and clarified that the value is less than that of a molecule on the surface. This knowledge is now standard in the field of Atomic Force Microscopy.

A third contribution is his work advancing nc-AFM in ambient conditions. The ability to image individual atoms in this environment paves the way for its future use not only in Surface Science but also in other scientific branches such as Chemistry and Biology.

