



PHYSIKALISCHES KOLLOQUIUM

Referent:

Prof. Dr. J. Peter Toennies

Max Planck-Institute for Dynamics and Self-Organization,
Am Fassberg 17, 37077 Göttingen,
Germany



Thema:

Superlarge Clusters of Helium and Clusters in Superfluid Helium

Zeit und Ort:

Dienstag, 13.11.2018, 16:40 Uhr
Recknagel-Bau, Hörsaal REC/C213, Haeckelstr. 3

Leiter:

Prof. Dr. Marc Timme

Kurzfassung:

Helium is the most extraordinary of all the elements. It remains liquid down to zero Kelvin and is the only naturally occurring superfluid. The first part of my talk concerns small clusters which are readily produced in cryogenic free jet expansions. Only by matter wave diffraction was it possible to measure the bond distance of $\langle R \rangle = 52 \text{ \AA}$ making it by far the largest diatomic molecule. By laser Coulomb dissociation the structure of the He trimer was found to have a huge *counter-intuitive excited* state, predicted by Efimov in 1970, with more than 100 \AA size, making it comparable to a DNA molecule. Larger clusters and droplets with $10^3 - 10^{12}$ atoms in the jet expansions cool by evaporation to final temperatures of only 0.37 K ($\sim 0.1 \text{ K}$ in ^3He). Embedded small molecules (e.g. OCS, SF_6) and molecular clusters exhibit infra-red spectra with extraordinary sharp rotational lines not found in ordinary liquids. This indicates that the molecules rotate freely inside the droplets. These spectroscopic experiments have established that finite-sized 4He droplets are indeed superfluid making them the coldest and gentlest of all matrices for spectroscopic studies. Present day experiments are directed at extending spectroscopy to large organic and biomolecules, to exploring the unique structures of cryo-organized clusters and their chemical reactions. Also the recent successful electron diffraction experiments and X-ray diffraction experiments carried out at SLAC on *individual* pure and doped droplets point the way towards many new exciting areas of research in physics, chemical physics and chemistry.

Biographie:

I grew up as the son of German immigrants in the USA and received my PhD in chemistry from Brown University in 1957. Then I came to Bonn in the group of Wolfgang Paul as a postdoc and habilitated in Physics in 1965. In 1969 I was appointed scientific member and director at the Max Planck Institute of Fluid Dynamics (Strömungsforschung), now MPI for Dynamik and Selforganisation, in Göttingen. I am an emeritus since 1998. My main research interests are intermolecular potentials, surface physics and small clusters of helium.

Mitglied von:



**DRESDEN
concept**
Exzellenz aus
Wissenschaft
und Kultur