surements to compete with present atomic clock standards (see box), the discovery of long-lived states in negative ions stored in ion storage rings, the acceleration of huge molecules, the interaction of multiply charged ions with surfaces, to issues in astrophysical atomic and molecular physics.

During a business meeting, Division members elected new representatives to the Board of our Division which in turn elected a new Chairman (Hartmutt Hotop from Kaiserslautern), Vice-Chairman (Elisabeth Källne from Stockholm) and Treasurer (Antoine Salin from Bordeaux), and completed the Board by co-option.

The physics was also combined with cultural events in Riga, mainly an organ concert in the Dome, chamber music in Wagner Hall, national folk dances, a reception in an historical building in central Riga and a splendid banquet to top off the week. The participants learnt much about the history of Riga and of Latvia and visited nearby castles despite the poor weather.

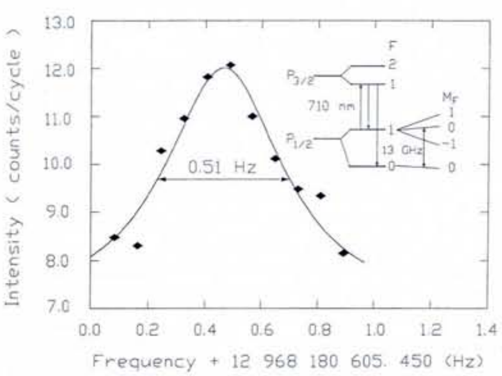
M. Barat
Université de Paris-Sud

A Significant Step Forward

HIGH PRECISION ION TRAP HYPERFINE MEASUREMENTS ON $^{207}Pb^+$

Ground-state hyperfine splittings (HFS) of ions in the GHz range have been determined in recent years using isotopes of Be^+, Mg^+, Ba^+, Hg^+, and Yb^+ in ion traps. These devices offer virtually unlimited observation times, extremely long coherence times under UHV conditions, and allow linewidths down to the mHz range in microwave-induced HFS transitions. Systematic lineshifts, which may arise from the trapping fields and the second-order Doppler effect, are of the order of 10^{-15} if the ions are laser cooled below 1 K; a first-order Doppler shift does not show up if the microwave transition wavelength is larger than the ion oscillation amplitude (the Dicke effect).

All experiments use the optical-microwave double resonance technique: optical pumping on a strong E1 transition creates a population difference between the ground-state hyperfine levels which is controlled by M2 microwave transitions between these states. The resonance is detected by variations in the fluorescent radiation from the ions.



Microwave-induced transitions between the $F = 1$, $m_F = 0$ - $F = 0$, $m_F = 0$ ground-state hyperfine levels in $^{207}Pb^+$. The statistical uncertainty of the 12.9 Ghz transition frequency is 78 mHz.

The same technique was applied to $^{207}Pb^+$. However, in this case the optical excitation was performed on a M1 fine-structure transition between the ground 6 $P_{1/2}$ and the excited 6 $P_{3/2}$ levels. Since the excited state lives as long as 47 s [Roth A. *et al.*, *Z. Phys. D* **8** (1988) 235], the transition amplitude is very small. The observed fluorescence count rate from the stored ions, which served to monitor the transition, was only a few photons per second. With careful shielding of any background light time delay between excitation and detection and repetitive use of the same ions — they were confined in the Paul-type trap for several weeks — a good signal-to-noise ratio was achieved: the final linewidth was 0.51 Hz at a 12.9 GHz transition frequency (see figure). Measurements of relaxation rates indicate that the final linewidth may be in the mHz range and that the present measurement is limited by phase jitter in the microwave oscillator [Feng X., Li G.Z. and Werth G., sub. to *Phys. Rev. Lett.*]. Since the measurement were performed on an uncooled cloud of about 10^5 ions, the main uncertainty comes from the second-order Doppler shift in the trap's potential and in part from the residual Zeeman shift in the stray magnetic field. The total error is quoted as 0.28 Hz (corresponding to 2×10^{-11}), while the statistical uncertainty is only 6×10^{-12}.

This is not just another example of high precision and extremely accurate spectroscopy, but represents a significant step forward in sensitivity which allows accurate spectroscopy even on highly forbidden transitions. Since $^{207}Pb^+$ has the simplest possible level scheme for these kind of measurements ($J = I = 1/2$) and the optical wavelength is very convenient, this ion may be considered as a potential frequency standard in the same way as some of the ions mentioned earlier. However, the necessary reduction of the second-order Doppler shift cannot be achieved by direct laser cooling because of the low scattering rate of photons on the 6 $P_{1/2}$ - 6 $P_{3/2}$ M1 transition. Sympathetic cooling by other simultaneously stored and laser-cooled ions [Larson D.J. *et al.*, *Phys. Rev. Lett.* **57** (1986) 70] could be one way to reduce the ion temperature substantially and bring the accuracy into the 10^{-15} range.

X. Feng, G.Z. Li and G. Werth
Institut für Physik, Universität, Mainz

A.R. Miedema

The scientific community was hit with the sad news that Andries Miedema died unexpectedly of a sudden illness on 28th May, at the age of 58. He had been the Adjoint-Director of the Philips Research Laboratories in Eindhoven, The Netherlands, since 1980 and was responsible for Basic Physics and Materials Science. After his studies and thesis work at the Kamerlingh Onnes Laboratory of the University of Leiden, he became Professor of Experimental Physics at the Natuurkundig Laboratorium of the University of Amsterdam at the age of 31. He joined the Philips National Laboratory in Eindhoven in 1971 as a senior scientist.

At Leiden, he did beautiful work in low-temperature physics that remains highly relevant today. I have on my desk a note, written by Andries only a couple of days ago in his characteristic manner, suggesting an interesting experiment which goes back to his Leiden work. In Amsterdam, he was one of the first experimentalists to show that some of the two-dimensional structures dreamed about by theoreticians could be realised in Nature with real substances. At Philips, he developed the elegant and surprisingly simple and effective "Miedema model" to explain in a beautifully consistent way the stability and reactivity of metals and alloys.

He was a member of the Royal Dutch Academy of Sciences and won (with E.O. Andersen) the 1980 Hewlett-Packard Europhysics Prize of EPS for work on cohesion in metals. At Eindhoven, he was the cornerstone of basic research and contributed significantly to the interface of fundamental research with industrial development. Apart from his great joy in physics, his main concern was the stimulation of students, young collaborators and friends to become grown-up, critical and creative scientists. Not only his scientific authority, but also his warmth, his understanding of human nature, his insight into organizational structures, and his been always able to offer stimulating and constructive advice, made him a highly efficient and much esteemed member of all sorts of evaluation committees, advisory boards, *Beiräten* and curatorial bodies throughout Europe.

We have lost a great physicist, a superb materials scientist and an intensly human research manager. I lost a friend. We shall remember Andries in his advice, in his work and in his students.

Peter Wyder, *Grenoble*