

## **Electron channeling at PRAE for the investigation of Zitterbewegung and/or internal clock**

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We propose to use the periodic Coulomb field of aligned atoms along a crystal atomic string to infer the internal frequency of the electron ( $km_0c^2/h$ ,  $k=1,2$ ), as predicted by L. De Broglie[1] (internal clock) and E. Schrödinger [2] (Zitterbewegung).

A previous experiment performed at ALS-Saclay [3] concluded to a modification of the angular distribution at the exit of a silicon crystal aligned along the  $\langle 110 \rangle$  axis with respect to the incident beam, when the beam energy matches the resonance energy.

The PRAE facility may provide suitable conditions for a verification experiment at energies that are needed for such an experiment using axial channeling in thin diamond crystals.

The requirements are the following. Low emittance beams (0.1 pi.mm.mrad), with low momentum spread ( $dp/p < 10^{-3}$ ) will be used to describe the resonance by small energy steps ( $dp/p \sim \text{some } 10^{-3}$  per step) in the range 51-54 MeV. A thin diamond crystal (few  $\mu\text{m}$  thick) held by a goniometer will be used as a target. The detection setup will consist in a position sensitive detector located 3-5 m downstream, which will record the beam spatial distribution for each energy step.

[1] L. de Broglie, Thèse de doctorat, Paris (1924).

[2] E. Schrödinger, Sitzungb. Preuss. Akad. Wiss. Phys. Math. Kl 24 (1930) 418.

[3] P. Catillon, N. Cue, M.J. Gaillard, R. Genre, M. Gouanère, R. Kirsch, J.-C. Poizat, J. Remillieux, L. Roussel, M. Spighel, Found. Phys. 38 (2008) 659–664.