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A new Brillouin Spectroscopy Laboratory for the Study of Minerals at High Pressures and Temperatures

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A new Brillouin scattering laboratory has been constructed at the GeoForschungsZentrum (GFZ) Potsdam. Brillouin effect is the inelastic scattering of light by low frequency thermal vibrations – i.e. sound waves – in a transparent medium. From the kinematic relations we can determine acoustic velocities and elastic moduli in the medium. In single crystals, knowing the orientation and polarization of the scattering phonon it is possible to determine, by Brillouin scattering, subsets or the entire set of the elastic constants of the scattering material. The system that we have constructed at GFZ Potsdam is based on a Sandercock-type tandem multipass interferometer equipped with a photomultiplier tube for signal detection. The laser source is a solid state green laser (Nd:YVO_4, λ = 532 nm). Our system is characterized by a 400-mm Eulerian cradle combined with horizontal rotation stage and equipped with high resolution X-Y-Z translation stages for the accurate control of the scattering geometry, which is critical for the accurate determination of sound velocities and elastic constants. The choice of a very large Eulerian cradle allows us to build a variety of experimental setups including diamond anvil cells of different design and resistive heating apparatus with enough space for the implementation of thermal insulation. Together with the details of the setup and the capabilities of our system we also present the first experimental results from crystalline and amorphous phases.