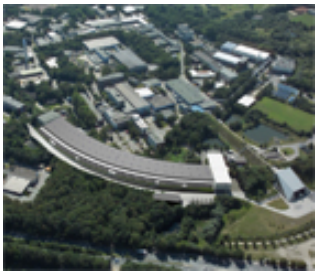

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Towards Mbar-pressures at deep Earth's interior representing samples - the challenge of new light source based high pressure techniques for process research of the next decade and beyond

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The Earth's mantle has a mass of about 4.08 x 10 exp 21 tons and represents 68 % of the total mass of the Earth. The Earth's mantle is only accessible by indirect methods, first of all seismological studies. The interpretation of these seismic data from the Earth's deep interior requires measurements of the elastic and inelastic properties of Earth materials under experimental simulated mantle and core-mantle boundary (CMB) conditions, i.e. conditions representative for Earth's deep interior. New seismological techniques based on the dense global station network resulted in fundamental improved knowledge about deep structures, as subduction down to the CMB, accumulation of low viscous material above the CMB, detection of rising plumes etc. One fundamental lesson from that is - contrary to classical imaginations deep Earth is just the opposite of beeing simple and stratified. There are clear relations between the Earth's interior and surface and atmospheric processes as climat development. The investigation of complex processes requires, technically speaking, strong controlling of gradients and assuring of minimum dimensions to truly represent natural conditions. There is also a strong indication of widespread unquenchable phases at extreme conditions requiring necessarily in situ observations. Recent geophysics sets of the tasks, recent material sciences and engineering delivers the tools, recent light source based mineral physics supplies recent numeric modeling with indispensable data to solve the geodynamic problems. The paper presents and summarizes some innovative high pressure techniques developed or under development for geoscientific experiments at light sources worldwide, including the techniques and results of the corresponding author's experiments at DESY beamlines.

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