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Silicon abundance in the Earth's core constrained by a multi-technique approach

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The presence of light elements alloyed to iron in the Earth's core is well established, and core formation models based on metal-silicate equilibration point at silicon as one of the major light element in the inner core. However, attempts to constrain silicon abundance on the basis of comparison of velocities and densities of iron and iron alloys at high pressure and high temperature with seismic observations so far did not provide a unique answer.

In this talk I will present sound velocity (compressional velocity V_P and shear velocity V_S) and density (ρ) measurements on Fe and Fe-Si alloys at high pressure and high temperature obtained by complementary use of x-ray diffraction, inelastic x-ray scattering and picosecond acoustics. These results, combined with previous experiments and calculations, allow a precise determination of the V_P-ρ and V_S-ρ relations for Fe and Fe-Si alloys, and consequently to address the effect of Si on the velocities in the Fe-FeSi system in the range of Si concentrations 0 to 9wt.%, applicable the Earth's core. Combined with further constraints coming from melting curve determinations, these results will be used to discuss the Si abundance in the Earth's inner core.

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