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A python package for fast interior modelling of terrestrial (exo-)planets using a Gibbs free energy minimization

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With increasing capabilities of characterizing small rocky exoplanets beyond our solar system, the question of their chemistry, geology and interior structure arises. Accompanied by observational facilities capabale of giving a deeper look into this topic than ever before, modelling of the interior structure of exoplanets has become a standard procedure in the emerging field of exogeology. Most often, these research uses a simplified mineralogy – consisting of the major phases formed by $Mg_xFe_{1-x}SiO_3$ and $Mg_{2x}Fe_{2(1-x)}SiO_4$ - to construct the density profile of the planets mantle. Others have used the more sophisticated, but computationally expensive procedure of Gibbs free energy minimization to find the mantle equilibrium mineralogy (and hence its thermodynamical properties) from the first order chemistry of the planet. Here, we present a new Python/Cython software package capable of quickly inferring exoplanet interior structure by using a linearized Gibbs free energy minimization procedure - written in Cython - along an adiabatic mantle gradient. This simplifies and speeds up the interior structure modelling, reaching a runtime of ~7 seconds on a standard desktop PC for an Earth-sized planet, compared to ≥ 2 minutes with another interior structure and mineralogy solver, ExoPlex. We will demonstrate the use of the codes and its first application results at the assembly.