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From accurate atomic data to elaborate stellar modeling

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The Atomic physics field has served astronomy for a long time and it has also been stimulated by it. Despite the maturity of the field, the new requirements for accuracy and completeness from astronomers demand more challenging calculations. Current problems require the relaxation of approximations and a detailed study of different effects like relativistic effects, radiation damping and target expansions.

As an example, I will present the effect of the inner-shell transitions for opacities at high temperature - high density regimes and how the new opacities from The Opacity Project (OP) are crucial for stellar physics. Despite the overall good agreement with another source of data (OPAL,LLNL), the differences are noticeable. This new set of data is used to determine constraints on the solar composition and to shed some light on the 'Solar Convection Problem'. While the discrepancies between the two sources are minor for the Rosseland mean opacities, they affect more severely the radiative accelerations. The comparison between the accelerations computed with OPAL data and those obtained with OP data outlines how sensitive they are to details in monochromatic opacities. The consequences for stellar models will be presented.