Electron collisions with hydrogen – data available for applications

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Abstract. There are many applications in the astrophysics and plasma physics where data from electron-atom and electron-molecule collision calculations are necessary. Our work has been motivated by astronomers' need for accurate and detailed scattering data. Though electron-atom collisions are almost routinely simulated in many laboratories and institutes around the world, the freely available outcome is still scarce, whether we mean numerical data or free computer program packages. Our aim is to create a universal interface which would provide the astronomers and other physicists with an intuitive tool to retrieve the various cross sections and related quantities for processes of interest without a deep knowledge of underlying atomic codes and methods.

We believe that
(1) present situation in availability and usability of scattering data requires nontrivial understanding of the atomic physics computations, and substantial effort has to be spent to get relevant data, which makes an astronomer's life difficult,
(2) freely available scattering data even for such a basic process as the e-H collision are far from satisfactory – they are often too coarse and lack detailed structures such as resonances which can play an important role in applications,
(3) results of freely available computing packages do not necessarily agree with each other and are often difficult to use.

We addressed these deficiencies in the following way:
(1) appropriate methods (e.g. exterior complex scaling with the B-spline basis for low energies, higher order distorted wave Born approximation for high energies) has been implemented to judge among existing published programs and available data, they can even be used as a primary source of reliable data,
(2) fine enough data from which all necessary cross sections and other quantities can be obtained can be precomputed and stored in an appropriate format because obtaining these data is time consuming,
(3) finally an intuitive interface to get the data of interest from the precomputed data has been created for a casual black-box usage.