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Abstract for an Invited Paper
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Will Allis Prize Talk: Electron-Impact Cross Sections and Plasma Science[1]

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The title topic will be treated from the point of view of an experimentalist who spent the entire research carrier improving the experimental techniques for, and measuring, electron-atom and electron-molecule cross sections. Improvements of the instruments, permitting to measure at lower energies, with higher resolution and sensitivity, covering the entire range of scattering angles from 0° to 180°. etc., will be presented. The limitations of the experimental techniques will be discussed - the inability to measure cross sections of the majority of states because they lie too close in energy and cannot be resolved, the difficulties in providing complete sets of cross sections, and to provide cross sections for many atoms and molecules because of their low volatility (e.g., Fe atoms) or because of the difficulty to prepare them in sufficient quantity (e.g., the OH radical). A viable way out of this dilemma is a collaboration of experiment and theory whereby the experiment provides quantitative cross sections for representative cases, and these data is used to verify that a given theory is capable to reproduce them. The thus validated theoretical method is then used to calculate many more states and targets which are not accessible to the experiment. As a last topic it will be shown that 2-dimensional electron energy loss spectroscopy (2D EELS) provides experimental information on the dynamics of resonances in molecules. Examples will be shown where 2D EELS reveals that chemically related molecules have dramatically different capacity to thermalize electrons, presumably due to the presence of conical intersections between potential surfaces of the transient negative ions (negative ion resonances).

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