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On the sodium enhancement in spectra of slow meteors and the origin of Na-rich meteoroids

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Distinct Na-enhanced and Na-rich meteor spectra have been previously identified by different authors, but the explanation of their origin and interpretation of the corresponding meteoroid composition was lacking. To study this population, we utilized meteor spectra observations of the global AMOS network and high-resolution Echelle spectra of ablating meteorite samples obtained in a high-enthalpy plasma wind tunnel at the IRS facilities in Stuttgart. It was found that most Na-enhanced and Na-rich spectra can be explained by the effect of low meteor speed related to low ablation temperatures and generally do not reflect real meteoroid composition. Spectra obtained by the laboratory experiment simulating low meteor speeds show corresponding Na-rich spectral profiles irrespectively of the meteorite composition. For more clarity in the classification of Na-enhanced and Na-rich meteoroids, we propose new speed-dependent boundaries between the spectral classes. Based on this classification, we reveal real compositional Na enhancement in five cometary meteoroids including two Perseids, an □□-Capricornid, □□-Draconid and a sporadic. The two Na-enhanced Perseids were linked with increased material strength suggesting that the detected increase of volatile content has implications for the meteoroid structure.