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DIPLODOCUS: an anisotropic Boltzmann equation solver designed to model AGN jet dynamics and emissions

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We will present developments towards the DIPLODOCUS code (Distribution In PLateaux methodOLOgy for the Computation of Boltzmann eqUationS), written from scratch using the Julia coding language, and designed to kinetically model dynamics and emissions from AGN jets and other jetted sources. The code expands on the concept of multi-zone jet models to include anisotropic distributions in momentum space, allowing self-consistent particle transport along the jet axis. The code has two parts: to evaluate anisotropic particle interactions, a new framework has been developed to pre-compute collision integrals via Monte-Carlo sampling; and a conservative solver for general Boltzmann equations, which may include non-conservative forces such as radiation reaction. Both operate under a formalism denoted "distribution-in-plateaux", whereby the underlying particle distribution functions are discretised by use of Heaviside step functions, rather than Dirac delta functions which are used in particle-in-cell. As such, they uniformly sample momentum space, allowing constant accuracy over all energy ranges.

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