Comparison of Binary Black Hole Initial Data Sets MARK
SCHEEL, VIJAY VARMA, Caltech, SXS COLLABORATION — We present improvements to construction of binary black hole initial data used in SpEC (Spectral
Einstein Code). We introduce new boundary conditions for the elliptic equations
that enforce the excision surfaces to be slightly inside rather than on the apparent
horizons, thus avoiding extrapolation into the black holes at the last stage of initial
data construction. We find that this improves initial data constraint violations near
and inside the apparent horizons by about 3 orders of magnitude. We construct
several initial data sets including initial data in the harmonic and damped harmonic
gauges and compare them by evolving them. We show that the gravitational waveform extracted during the evolution of these different initial data sets agree very
well, after excluding the spurious transients known as "junk radiation". Among the
cases considered, harmonic initial data leads to significantly lower junk radiation,
smaller temporal variation in black hole spins and masses during the junk radiation
stage, smaller constraint violations, and better computational efficiency.

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