The Darboux transformation in black hole perturbation theory
DANIEL KENNEFICK, AARON JOHNSON, University of Arkansas, KOSTAS
GLAMPEDAKIS, Universidad de Murcia — In an extreme mass ratio inspiral
(EMRI), we consider a solar mass black hole as a perturbation on a supermassive black hole's (SMBH) spacetime. Both axial and polar perturbations lead to
the same equation with different potentials. In the 1970s, Chandrasekhar found
by brute force calculation that these potentials are isospectral. In the 90s, when
one of us visited to speak with Chandra, he mentioned his dissappointment that
people didn't consider this an important avenue of research and instead only used
the transformation for convenience. What has become known as the Chandrasekhar
transformation has been known for a century to mathematicians as the Darboux
transformation and plays an important role in scattering theory and supersymmetry. Here we discuss using the classical and generalized Darboux transformations to
find algebraically special solutions and relate potentials in black hole perturbation
theory, and more broadly how they might be used to find new potentials that are
shorter ranged and therefore better for computation.

Aaron Johnson
Univ of Arkansas-Fayetteville