Viscous dissipation of gravitational wave energy

We will consider scenarios where matter surrounding GW sources could potentially result in interactions between GWs and the intervening matter resulting in damping of the GWs. GWs are expected to interact very weakly with matter, if at all. There would be no transferral of energy in the case of the matter being traversed through, treated as an ideal fluid, as no mechanism exists for such a transfer. However, this may not be the case for viscous matter as Hawking first noted in the 1960's. In the flurry of activity with the first detections of GWs in 2015, this comment by Hawking went largely unnoticed. We considered various astrophysical situations where GW events occur enclosed by matter shells. The novel findings indicate that there will be scenarios where GWs do interact with matter surrounding the GW source and that such interaction leads to partial or, in extreme cases, complete damping of the GWs. These findings may significantly impact projections of incidence of anticipated signals from affected sources. However, damping, may also result in alternative detectable signals corroborating the phenomenon.