LoI EF02:

1) Complementarity of Higgs physics and Graviational Waves
2) The Higgs inverse problem

S. Heinemeyer[1,2,3*]

[1]*Instituto de Física Teórica (UAM/CSIC), Universidad Autónoma de Madrid, Cantoblanco, 28049, Madrid, Spain*

[2]*Campus of International Excellence UAM+CSIC, Cantoblanco, 28049, Madrid, Spain*

[3]*Instituto de Física de Cantabria (CSIC-UC), 39005, Santander, Spain*

Concerning EF02 I find the following ideas interesting/relevant:

1. Complementarity of Higgs physics at Colliders and Graviational Waves
   Extended Higgs sectors can be tested in several ways: The Higgs boson at ~ 125 GeV has to be in agreement with the measurements at the LHC; the extended Higgs sector has to be in agreement with the searches at the LHC (and LEP); the Higgs sector has to be in agreement with flavor observables, electroweak precision observables etc.

   Extended Higgs sectors can also lead to a strong first order phase transition in the early universe that can (potentially) result in gravitational waves (GW). These GW are possibly in the reach of the (approved) LISA experiment.

   I think it will be of high interest to have a closer look at the interplay of collider/low-energy based experiments and GW detectors. Are they complementary? Can one make relevant predictions for the other?

2. The Higgs inverse problem
   The question is what can be learned from a possible observation of deviations in the Higgs-boson couplings from the SM prediction (Higgs inverse problem). For me the best way to deal with this is the following: work out deviations in the Higgs-boson couplings in various BSM models and compare them to the (potential future) measurements. Patterns and clearly model dependent predictios should be worked out. E.g. composite models normally show reductions in all Higgs-boson couplings, whereas 2HDM shown enhancements and reductions, etc. This should be contrasted with the direct reach of future colliders.

*email: Sven.Heinemeyer@cern.ch