Proposal for DA by KGWG-NIMS

- **Working groups**
  (Choose from CBC, Burst, CW, Stochastic, EM follow-up, Software and computing, MLA):
  - CBC
  - MLA

- **Research plan:**

1. Working group : CBC, Project: Deep Learning based CBC Search Pipeline & Astronomy
Description of research : NIMS group members are focusing on the machine learning based signal search algorithm for CBC sources. It is based on the matched filter method basically but various alternate way of finding new approaches are explored. Improving background estimation by using Deep learning is also included.

Members : Sanghoon OH, Edwin J. SON, John J. OH, Whansun KIM, Yeong-Bok BAE
Collaborators : Hyung Won Lee (Inje Univ.) Yusuke Itoh (Osaka City Univ.), Tjonnie Li (CUHK), Kazuhiro Hayama (Fukuoka U.), Hirotaka Takahashi (Nagaoka U. of Tech.), Takahiro Yamamoto, Takaaki Yokozawa (ICRR), Yuan-Chang Hann (NCU), Ting Wai Chiu (NTU), Sadakazu Haino (Academia Sinica), Yuki Inoue (Academia Sinica), Albert Kong (NTHU), Feng-Li Lin (NTNU), Chun Yu Lin (NCHC), Guo Qing Liu (Tamkang U.).

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Title: Deep Learning based CBC Search Pipeline & Astronomy

Research Items :

1. **Deep learning based CBC/GRB search pipeline using auxiliary channel information**
   Enlarge feature spaces with CBC/GRB features by adding more informations provided by auxiliary channels -- may improve classification performances / detection statistics, hopefully.

2. **Variational Inference based Parameter Estimation**
   One of deep algorithms, called variational inference, can search the physical parameters of CBC pipelines, in a different way with Bayesian inference. We investigate the feasibility of the application

3. **Generative Adversarial Newtork (GAN) can generate Merger-Ringdown waveforms**:
   MR phase waveforms are so expensive for computations because of full GR simulation. So GAN can generate the waveforms by competitive learning using relatively cheap computational costs.