



**Séminaire organisé par**

**AIM & Le service d'Astrophysique  
CEA/DSM/Irfu**



## **FORMATION OF BLACK HOLES IN THE DARK**

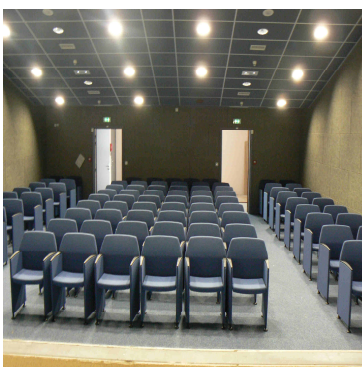
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A binary black hole with components of 30-40 solar masses as the source of gravitational waves GW150914 can be formed from a relatively isolated binary of massive stars if both black holes are formed by implosion, namely, by complete or almost complete collapse of massive stars with no energetic SNe accompanied by a sudden mass loss that would significantly reduce the mass of the compact objects, and in most cases unbind the binary system. Binary black holes can also be formed by dynamical interactions in globular clusters, if the black holes are formed with no energetic SNe that would kick the black holes out from the cluster before binary black hole formation. Besides, if black holes of  $\sim 10$  solar masses as in the source GW151226 are formed by implosion, the formation of binary black holes would be prolific, and their fusion would make an important contribution to a stochastic gravitational wave background. Theoretical models set mass ranges for black hole formation by implosion, but until recently observational evidences had been elusive. Here are reviewed the observational insights on the formation of black holes by implosion obtained by: (1) the kinematics of Galactic black hole x-ray binaries that set limits to putative natal SN kicks to black holes, (2) the absence in archived images of stellar progenitors of core-collapse SNe above 18 solar masses, (3) the identification of luminous stars that disappear without optically bright SNe, (4) the absence in the nebular spectra of type IIP SNe of nucleosynthetic products from progenitors above 20 solar masses, (5) the detection of gravitational waves from binary black holes. From the results in these areas of observational astrophysics, and the recently confirmed dependence of black hole formation on metallicity and redshift, it is concluded that a large fraction of massive stellar binaries in the universe end as binary black holes, and that black holes of  $\sim 10$  solar masses and even lower masses may be formed by implosion.

**mardi 11 octobre 2016**

**10h00 Salle Galilée bât 713 - Orme des Merisiers**



**Le petit-déjeuner précèdera le séminaire**

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