

Preuves d'un essaim de trous noirs au centre galactique

Un essaim de 10 000 trous noirs tournerait autour du trou noir supermassif de la Voie lactée. A la base de cette prédiction, les prévisions théoriques sur la migration des trous noirs dans notre galaxie et l'observation, par l'Observatoire de rayons X Chandra de la NASA, d'une surconcentration de binaires X au centre de la galaxie.

On sait que le centre de notre galaxie, la Voie lactée, abrite un trou noir appelé A* du Sagittaire (Sgr A*) d'environ 3,7 millions de masses solaires. Autour de ce trou noir supermassif devrait se trouver une forte concentration de trous noirs de masse stellaire, qui auraient migré vers le centre galactique sur une période de plusieurs milliards d'années. Les trous noirs de masse stellaire se forment au cœur des supernovas, si la masse de l'étoile qui explose est d'environ cinq à dix fois celle du Soleil.

Lorsqu'un objet aussi massif se déplace dans un espace peuplé d'étoiles moins massives mais plus nombreuses, les corps les plus légers prennent de la vitesse, tandis que le plus lourd ralentit. Ces interactions à deux corps successives font que les corps plus lourds tombent vers le centre galactique, alors que étoiles légères s'éloignent vers la périphérie de la galaxie. Une telle ségrégation de masse est bien connue dans les amas globulaires denses et, d'après une prédiction établie il y a dix ans, entraînerait la chute des trous noirs stellaires vers le centre de la galaxie. Compte tenu du nombre estimé d'étoiles et de trous noirs dans la région du centre galactique, cet effet devrait produire un essaim dense de 20 000 trous noirs dans un rayon de trois années-lumière de Sgr A*.

Une fois rassemblés près de Sgr A*, les trous noirs s'approchent fréquemment d'étoiles normales du voisinage, dont certaines appartiennent à des systèmes binaires. Du fait de sa forte gravité, un trou noir peut capturer une étoile ordinaire qui "change ainsi de partenaire" pour s'apparier avec lui. Ce processus devrait donner naissance à plusieurs centaines de systèmes binaires comprenant un trou noir ou une étoile à neutrons.

Les observations de la région centrale de la galaxie par le télescope à rayons X Chandra apportent aujourd'hui la preuve d'une forte concentration de systèmes binaires autour de Sgr A*. M P Muno, de l'Université de Californie, Los Angeles, et ses collègues ont identifié quatre sources binaires X actives à moins de trois années-lumière de Sgr A*, alors que les chances d'en trouver une seule dans un périmètre aussi petit ne sont que de 20%. Cette estimation se fonde sur la densité des sources observées à des distances légèrement supérieures

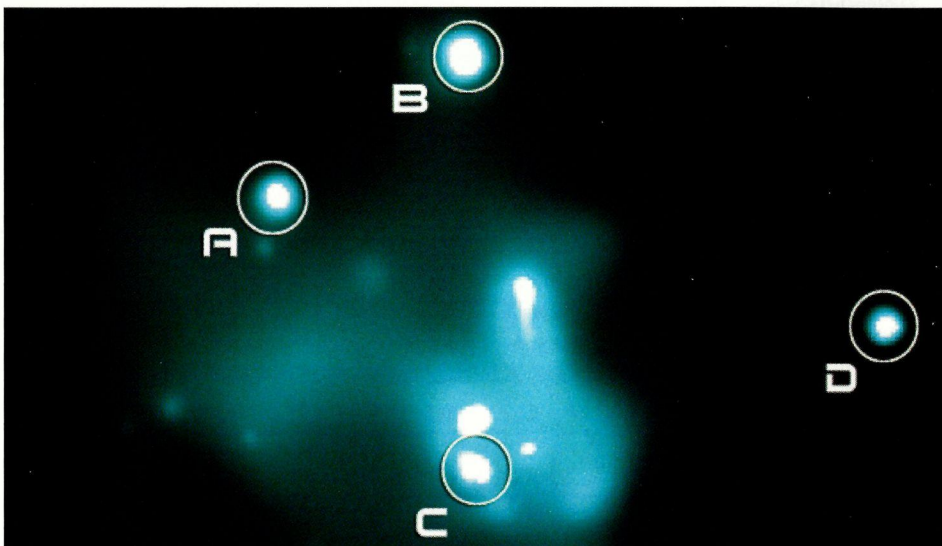


Image en rayons X du centre de notre galaxie obtenue par le satellite Chandra. Les quatre sources identifiées sont des systèmes binaires variables comprenant un trou noir ou une étoile à neutrons; ils sont situés à moins de trois années-lumière de Sgr A*. (NASA/CXC/UCLA/M P Muno et al.)

La photo du mois

Cette galaxie relativement proche, photographiée par le télescope spatial Hubble, pourrait bien être la plus jeune galaxie jamais observée, dans la mesure où ses étoiles ont toutes moins de 500 millions d'années. Cela signifie que dans cette galaxie, appelée I Zwicky 18, les premières étoiles n'ont fait leur apparition qu'environ 13 milliards d'années après le big-bang. A présent, les étoiles se forment à un rythme très élevé dans ses deux grumeaux blancs-bleus. Cette proche galaxie naine permet d'étudier les types de galaxies qui ont occupé l'Univers primordial et dont on pense qu'elles seraient les briques fondamentales de galaxies spirales comme notre Voie lactée. (NASA; ESA; Y Izotov, Observatoire astronomique principal de Kiev, Ukraine, et T Thuan, Université de Virginie.)



de Sgr A*, entre trois et 75 années-lumière. La surabondance de sources binaires X (d'un facteur 20) ainsi calculée donne à penser qu'un nombre gigantesque de trous noirs et/ou d'étoiles à neutrons se sont rassemblés au centre de la galaxie.

Bien que cette étude montre clairement un excès de binaires X au centre même de la galaxie, il est difficile d'extrapoler à partir des quatre sources qui sont actives à un moment donné le nombre total de trous noirs tournant autour de Sgr A*. Nombre de processus sont difficilement quantifiables, en

particulier la proportion de trous noirs et d'étoiles à neutrons appariés à une étoile normale pour former un système binaire X, ainsi que le degré d'activité de ces systèmes. D'autres études théoriques et observations seront nécessaires pour confirmer la présence d'un essaim d'environ 10 000 trous noirs au cœur de notre galaxie.

Pour en savoir plus

M P Muno et al., soumis à *ApJL*,
<http://arxiv.org/abs/astro-ph/0412492>.

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- Crate Controller: VME- PCI, VME- USB2 bridges,
CAMAC- PCI, CAMAC- VME, CAMAC- USB2 bridges
- Power Supplies: Multi-channel programmable "low-noise" Floating DC
power supplies for standard and hostile environment
(magnetic field tolerant and radiation hard), up to 6kW
output power
- Slow Control: CANbus, TCP/IP-Telnet, OPC-Server, Crate and Power Supply
Monitoring Software

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