

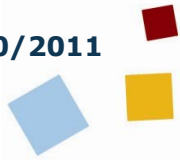
Analyse et interprétation des données de H.E.S.S., Observations multi-longueur d'onde, Cas scientifique CTA,

Les Vestiges de supernova et Nébuleuses de pulsars

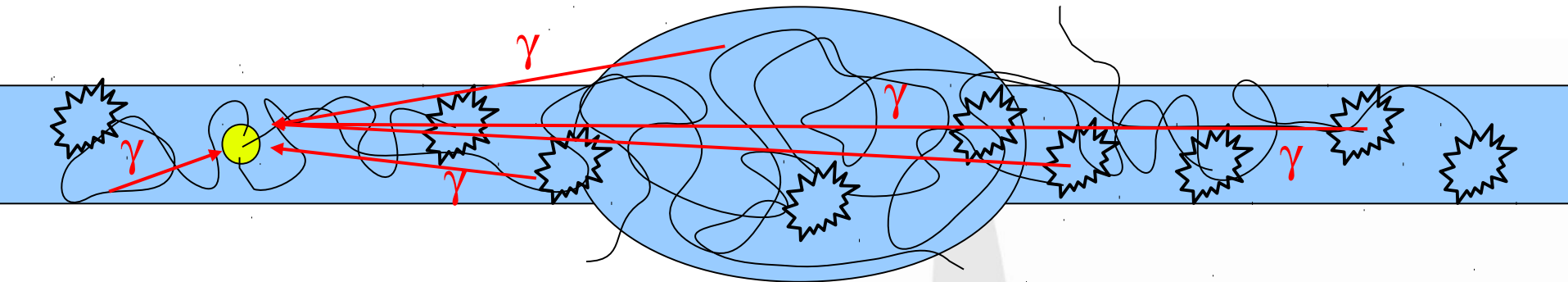
Fabio Acero, Diane Fernandez, Yves Gallant, Alexandre
Marcowith, Jérémie Méhault, Matthieu Renaud, Anna Zajczyk

Sources à l'origine du rayonnement cosmique galactique observé sur Terre...

11/10/2011

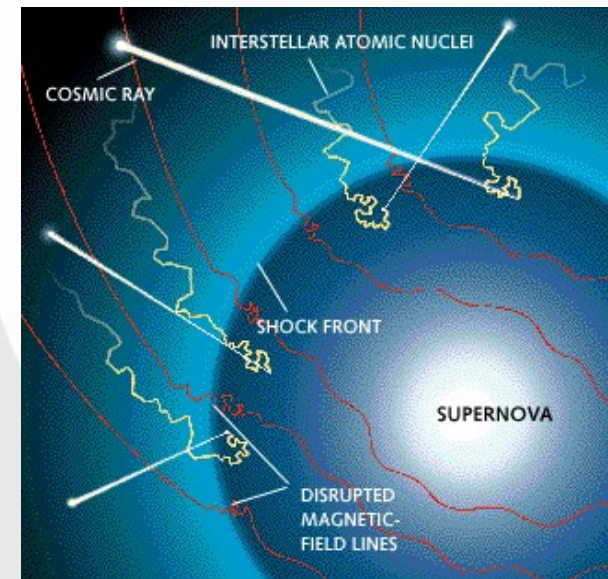


protons & noyaux : 99% Propagation dans la matière Accélération dans des
électrons : 1% & champ magnétique sources extrêmes
Origine ? Conditions ? Nature ?



Une explosion stellaire a lieu environ 2-3 fois par siècle dans notre Galaxie.

- les éléments lourds synthétisés (*Carbone, Fer...*) sont relâchés dans le ISM...
- accélération de particules au cours de l'évolution du vestige de supernova...



11/10/2011



Vela Senior

Puppis A

$E < 1.3 \text{ keV}$

$E > 1.3 \text{ keV}$

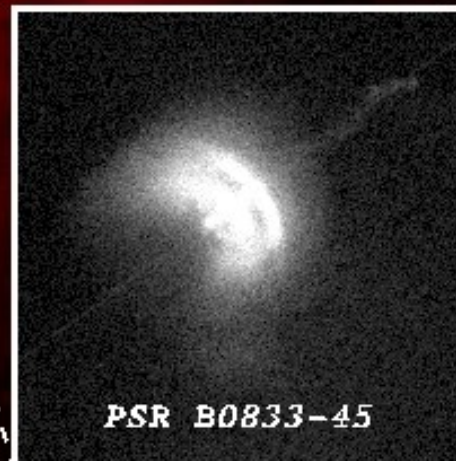
H.E.S.S.

Cocon de Vela

Vela Junior

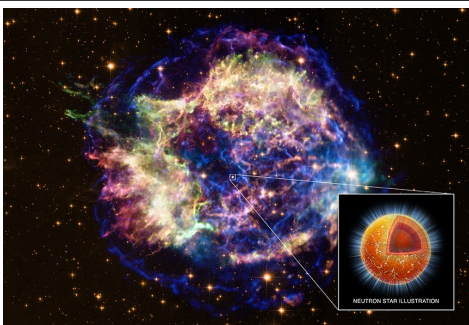


Lune



PSR B0833-45

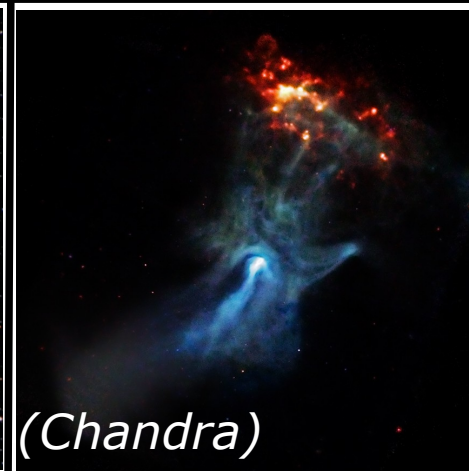
Cas A



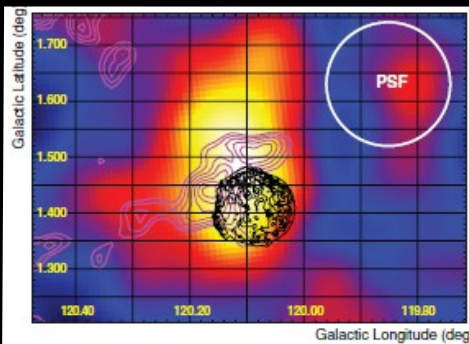
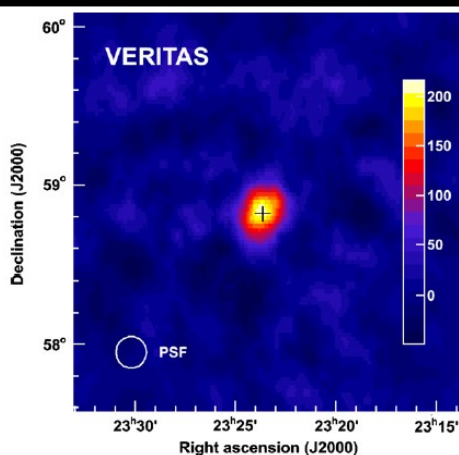
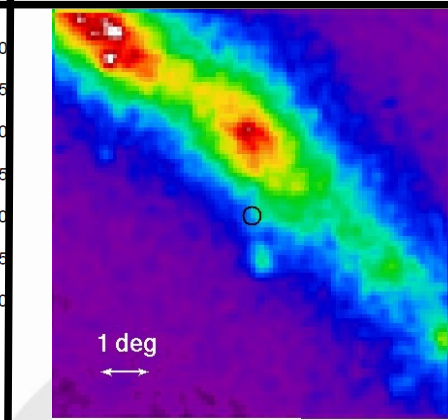
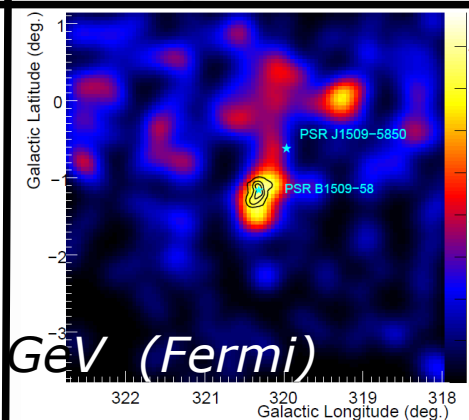
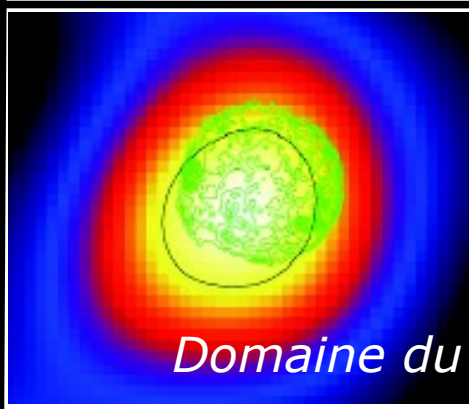
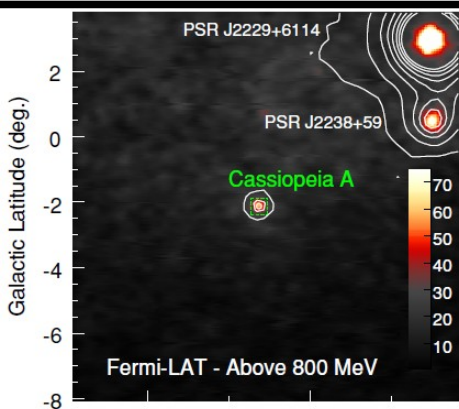
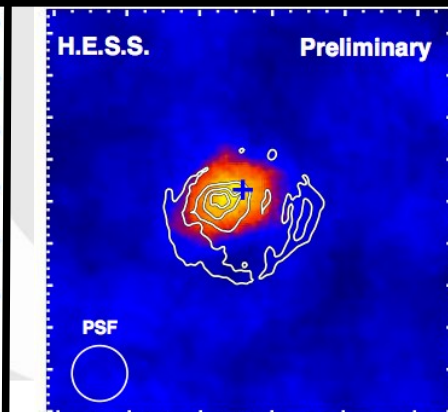
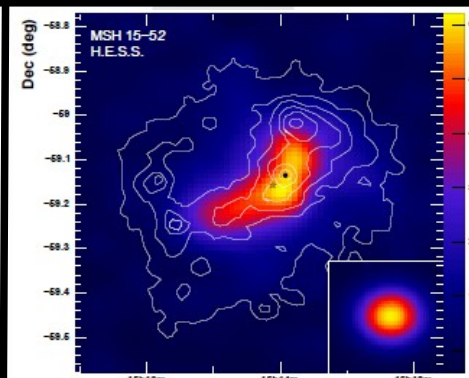
Tycho (SN 1572)

*Rayons X (Chandra)*

MSH 15-52

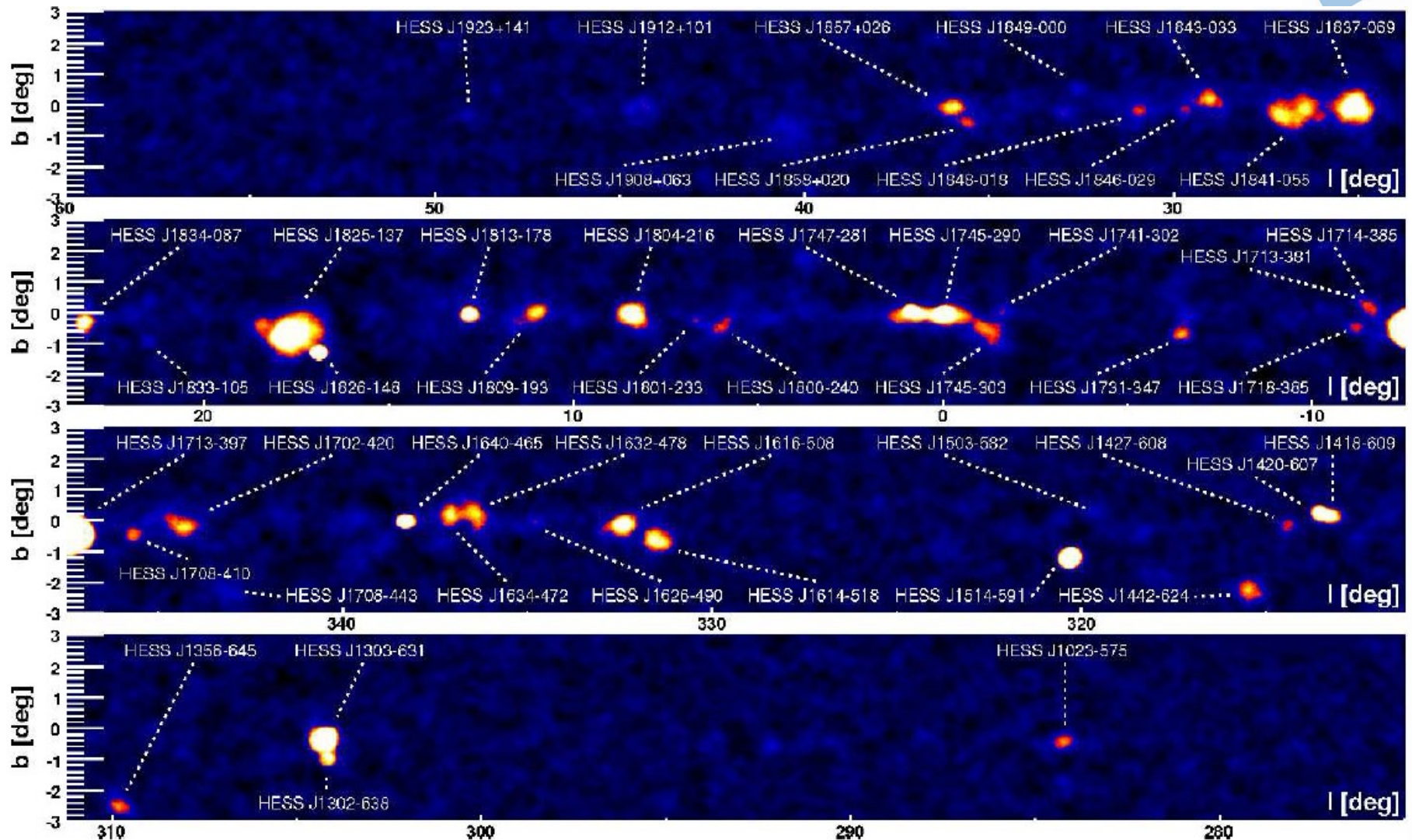


G327.1-1.1

*TeV (H.E.S.S., VERITAS)*

Balayage du plan galactique avec H.E.S.S.

11/10/2011



Plus de 50 sources détectées... dont **+20 dites « sombres »** (sans contrepartie en radio, X)

Analyse H.E.S.S. : « ParisAnalysis »

11/10/2011

The screenshot shows the ParisAnalysis Interface with a sidebar on the left containing menu items: Target and Run List, Excluded Regions, Reconstruction, Event Selection, TMVA, Micro DST, Background Subtraction, Plots, MC, Scaled Tables, 3D Model Calibration, Spectrum Tables, Morphology Tables, Tables Merging, Spectrum, Morphology, Merging, Environment, DST, Output, and Profiles. The main panel is divided into several sections: General Options (Chain Name: PuppisA_ModelPlus_Std_NewAna, Template: %t_%p), Target (Target: PuppisA, Lookup button, Custom position checked, RA/Dec, Gal. Long/Lat selected, G. Long: 260.40, G. Lat: -3.40, Radius: 3.00, Advanced button), Standard Analyses (Profile: Model++ Std), Run Selection (Radio buttons for ASCII File, Single Run, Database, Auto. Generated selected, Loose Selection unchecked, Run Selection button, Number of selected runs: 66), and a bottom section with Run Analysis, Submit Analysis, Preload DSTs, and Reset default config buttons. A status bar at the bottom indicates 'Sorting data 100%'.

Sélection des runs
en direction de la
source d'intérêt



méthodes de sélection et
de reconstruction des
événements, estimation
du fond



Images, spectres,
(courbes de lumière)



Morphologie, position,
paramètres spectraux



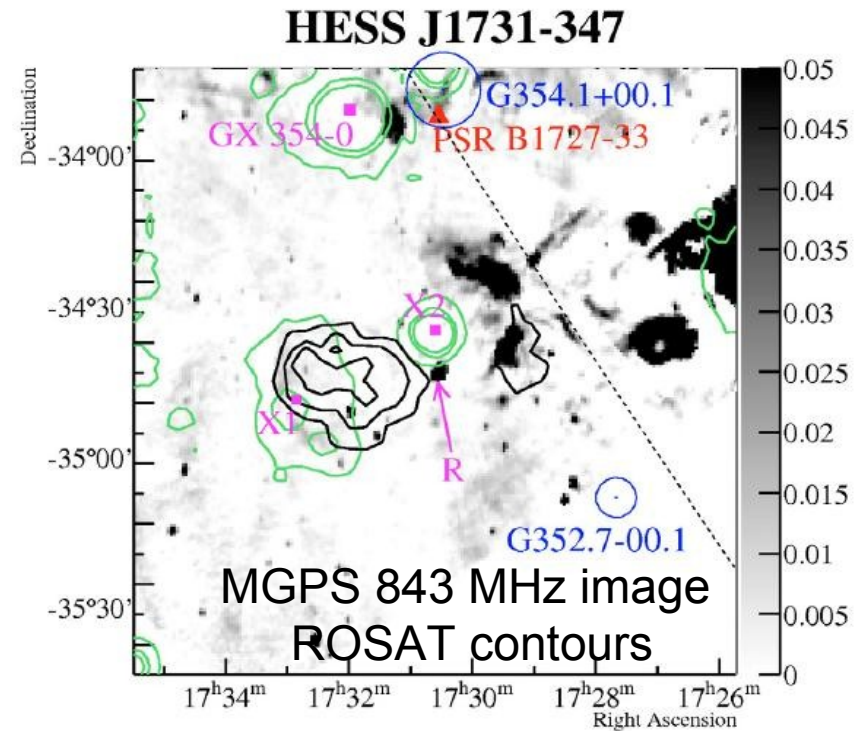
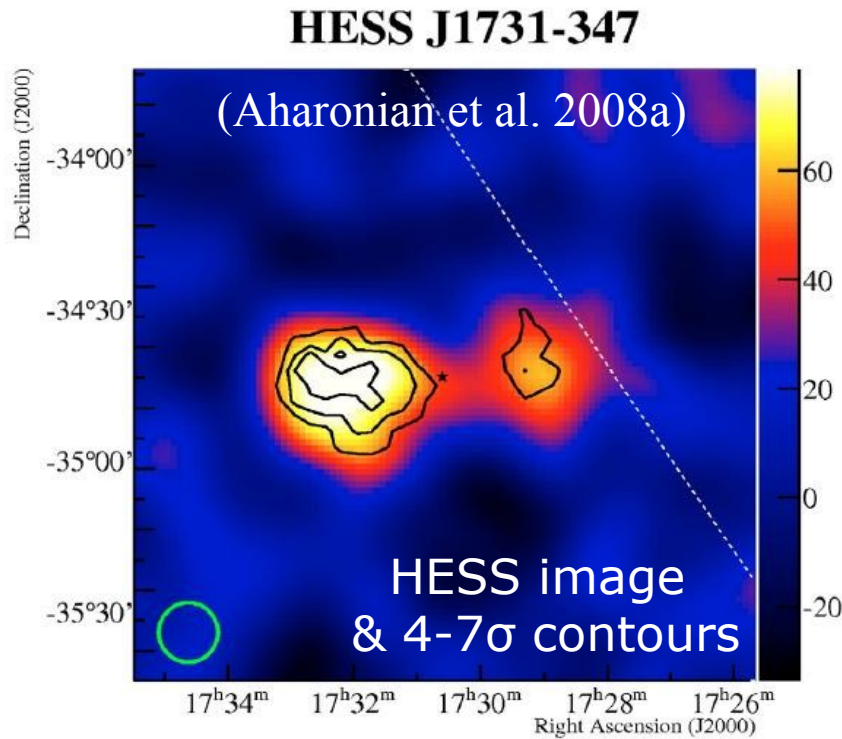
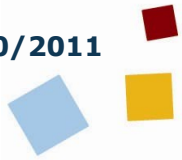
Analyse indépendante
pour vérification



Recherche de
contreparties dans les
données archivées MWL

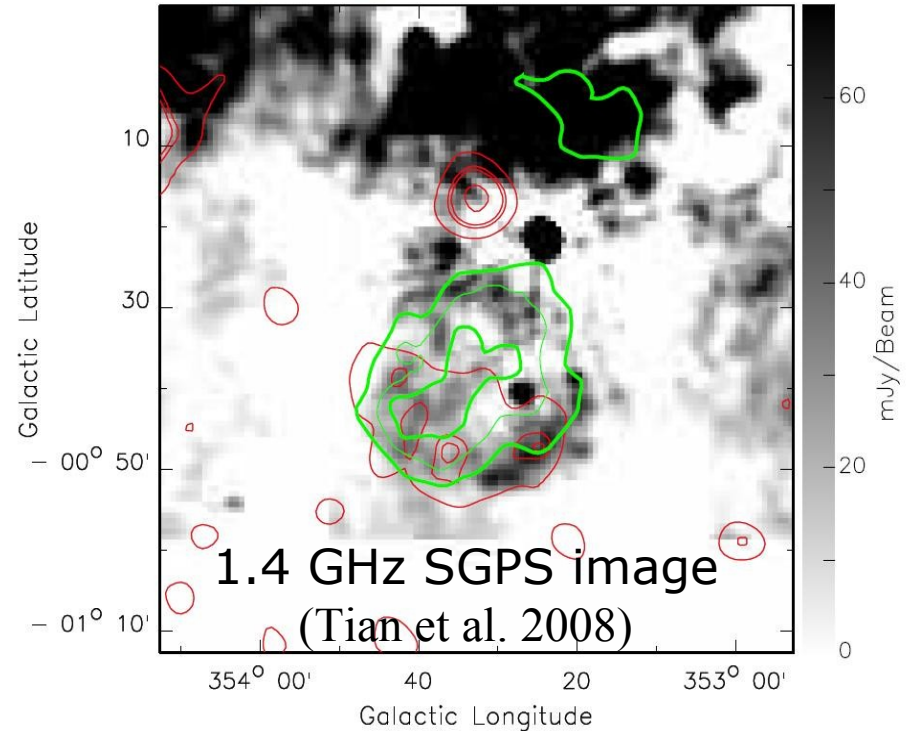
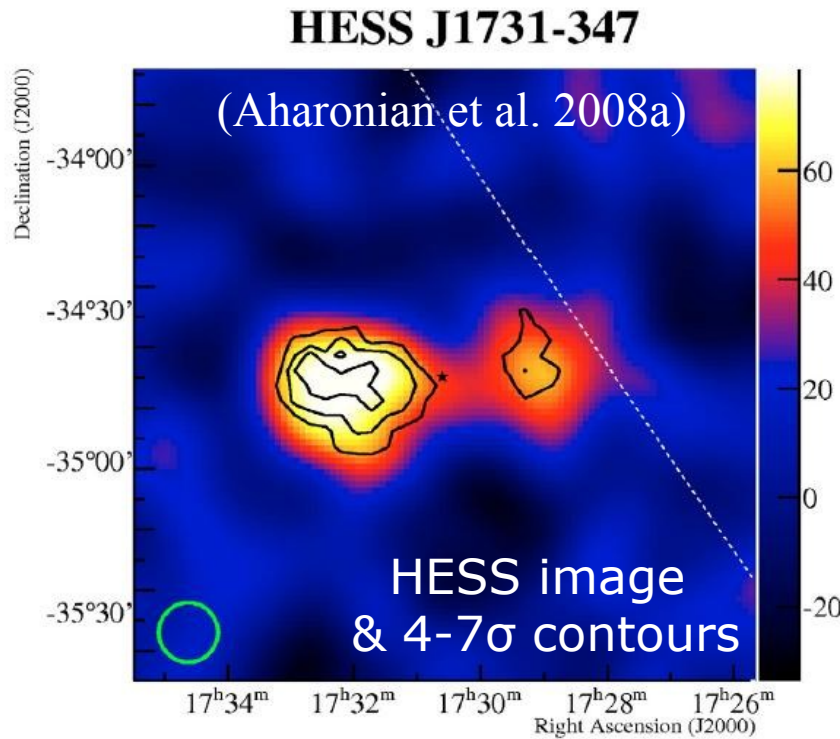
Un vestige de supernova (SNR) : HESS J1731-347... révélé par H.E.S.S. !

11/10/2011



Un vestige de supernova (SNR) : HESS J1731-347... révélé par H.E.S.S. !

11/10/2011

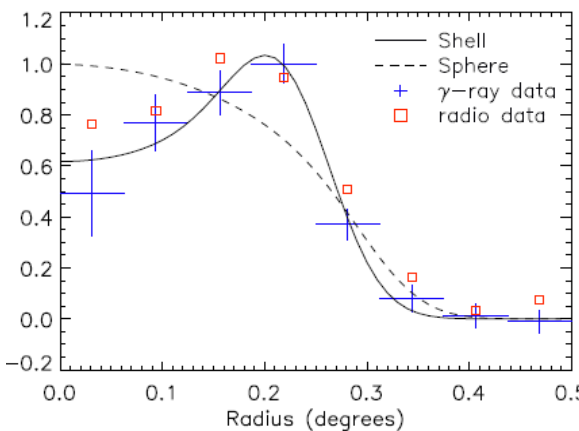
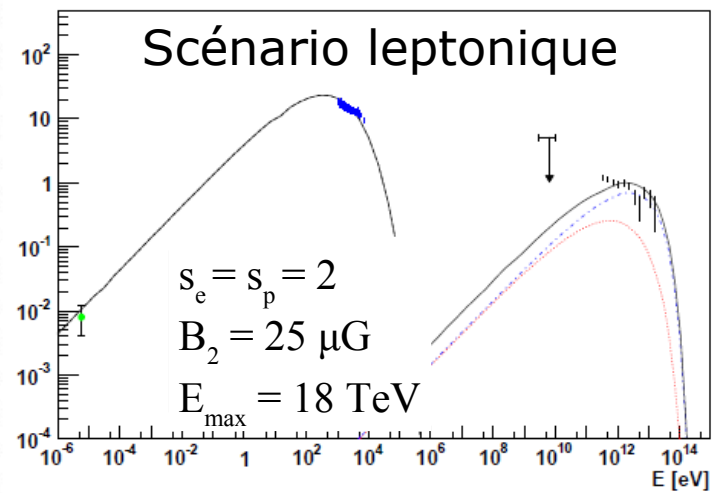
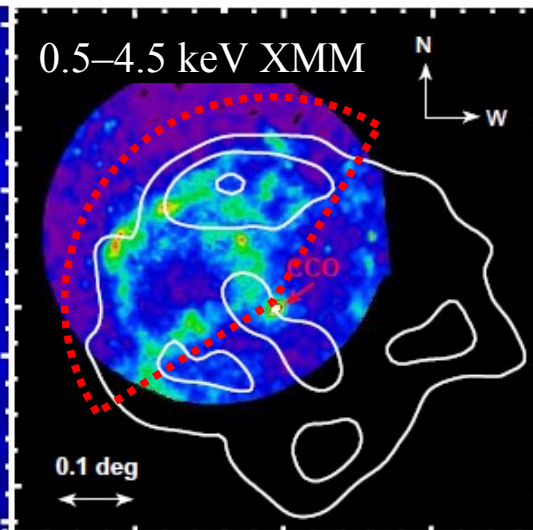
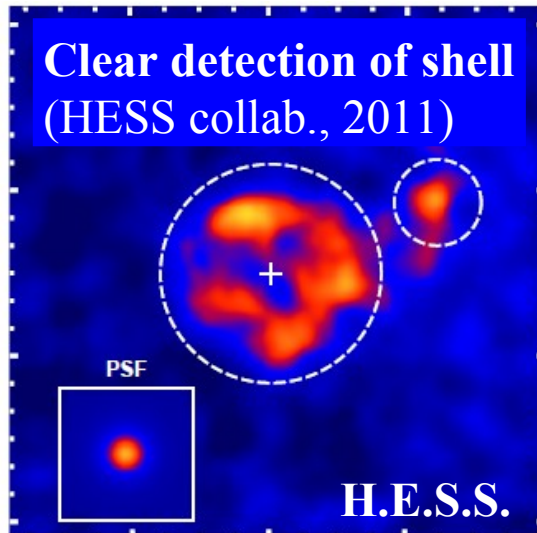


Un nouveau SNR à coquille G353.6-0.7 (Tian et al. 2008)

Absorption HI en direction d'une région HII adjacente : $d = 3.2 \pm 0.8$ kpc
Emission ROSAT coïncidente avec une partie du SNR... nature ? âge ?

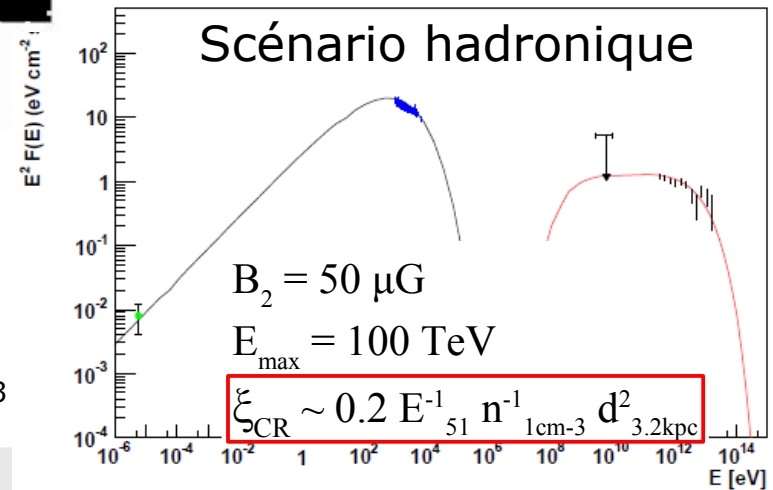
Un vestige de supernova (SNR) : HESS J1731-347... révélé par H.E.S.S. !

11/10/2011



Absence d'émission
thermique X

$n_{(kT>1\text{keV})} < 0.01 \text{ cm}^{-3}$



Astronomy & Astrophysics manuscript no. 16425
May 24, 2011

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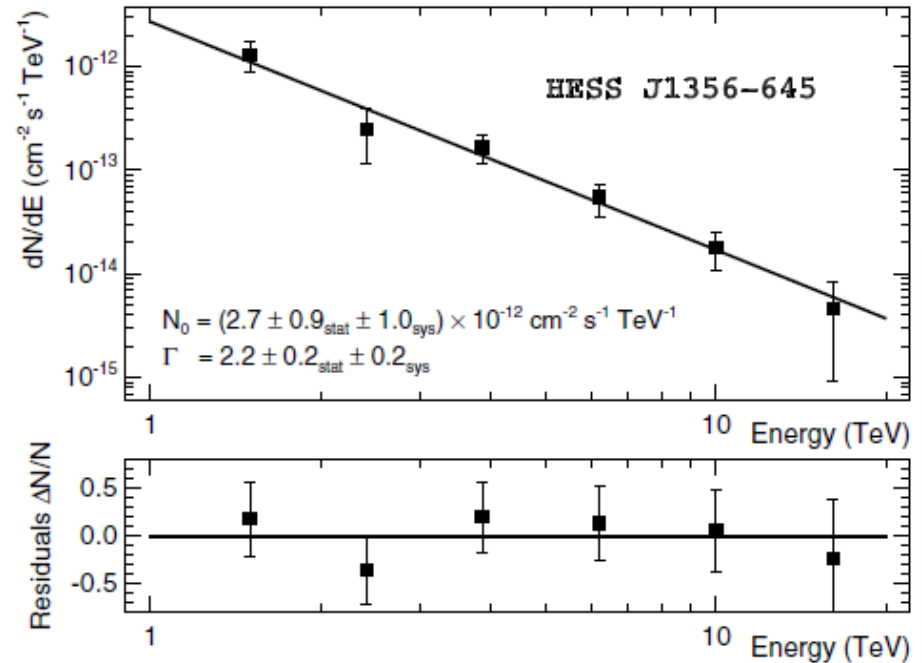
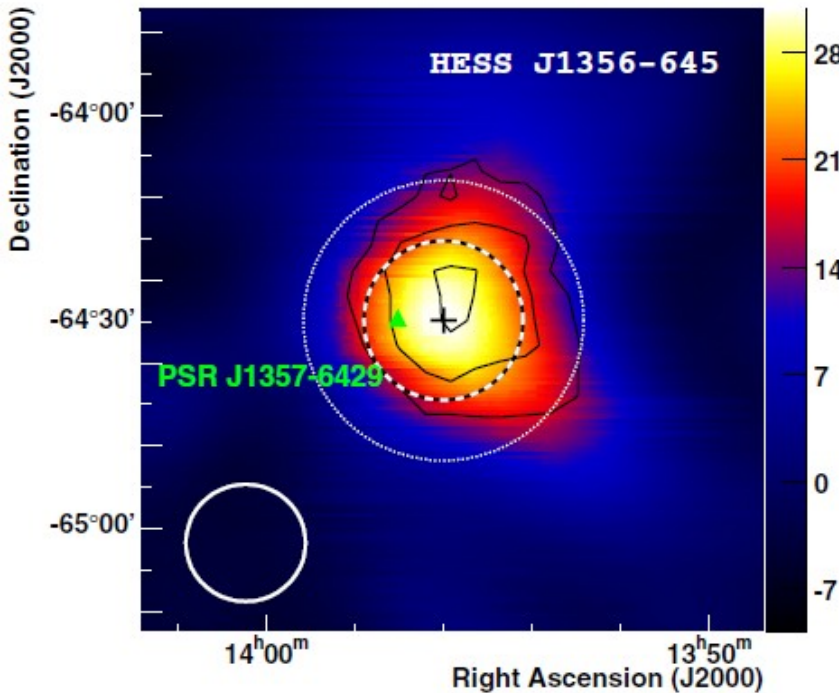
« Corresponding author » : **F.A.**

A new SNR with TeV shell-type morphology: HESS J1731-347

HESS Collaboration, A. Abramowski¹, F. Acero², F. Aharonian^{3,4,5}, A.G. Akhperjanian^{6,5}, G. Anton⁷, A. Balzer⁷,

Une nébuleuse de pulsar (PWN) : HESS J1356-645

11/10/2011



Source au TeV étendue, proche d'un pulsar détecté en radio, « jeune » ($\tau_c = 7.3 \text{ kyr}$), énergétique ($\dot{E} = 3.1 \times 10^{36} \text{ erg/s}$) et proche (2.4 kpc)...

A&A 533, A103 (2011)
DOI: 10.1051/0004-6361/201117445
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**Astronomy
&
Astrophysics**

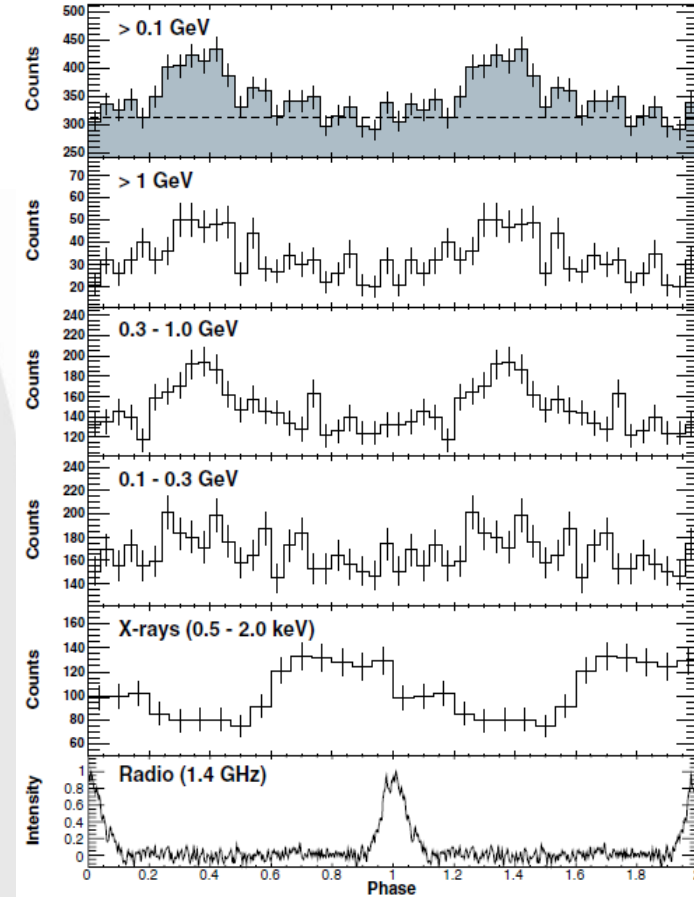
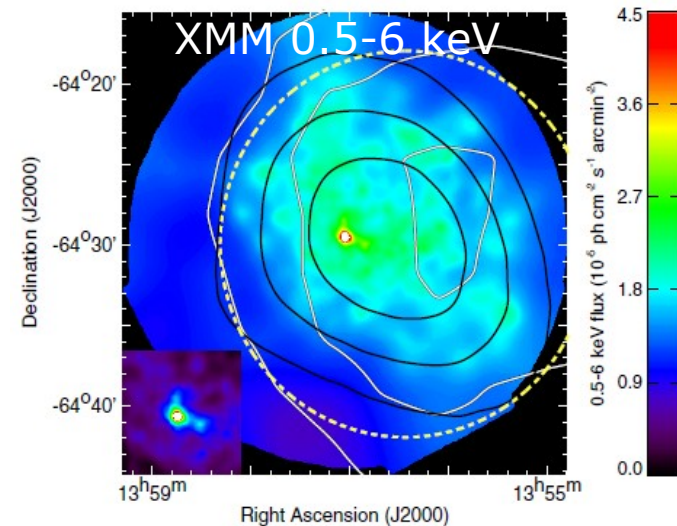
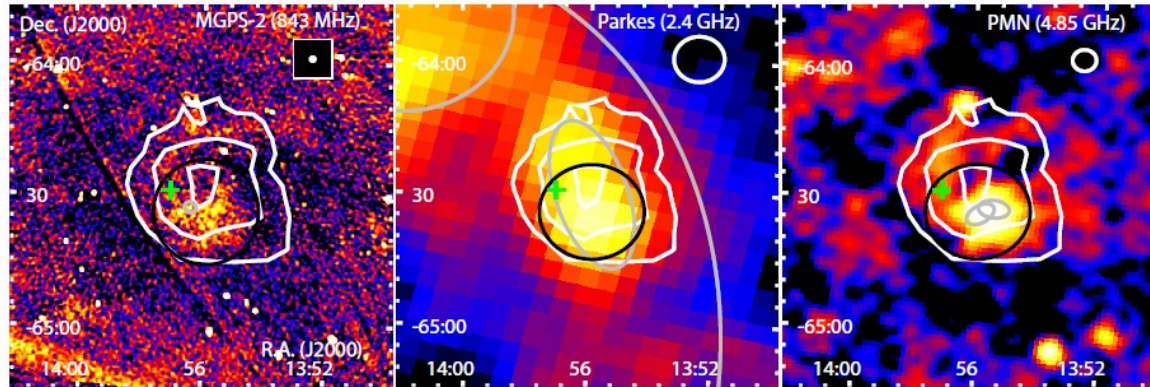
« Corresponding authors » : **M.R. & F.A.**

**Discovery of the source HESS J1356-645 associated
with the young and energetic PSR J1357-6429**

Une nébuleuse de pulsar (PWN) : HESS J1356-645

11/10/2011

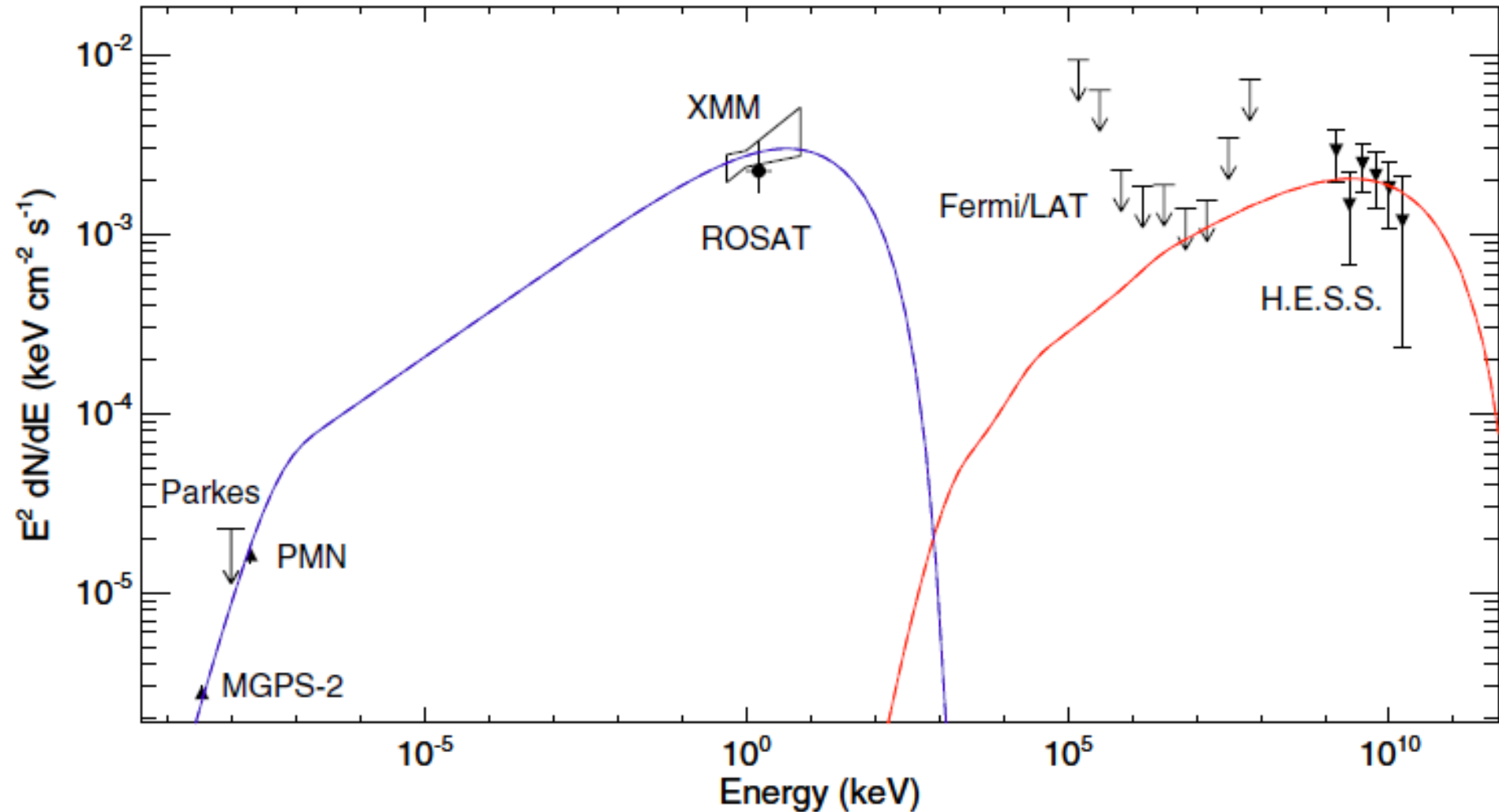
Images radio (0.843, 2.4, 4.85 GHz)



Contreparties radio et X détectées, contraintes au GeV $\rightarrow$ PWN « évoluée »

Une nébuleuse de pulsar (PWN) : HESS J1356-645

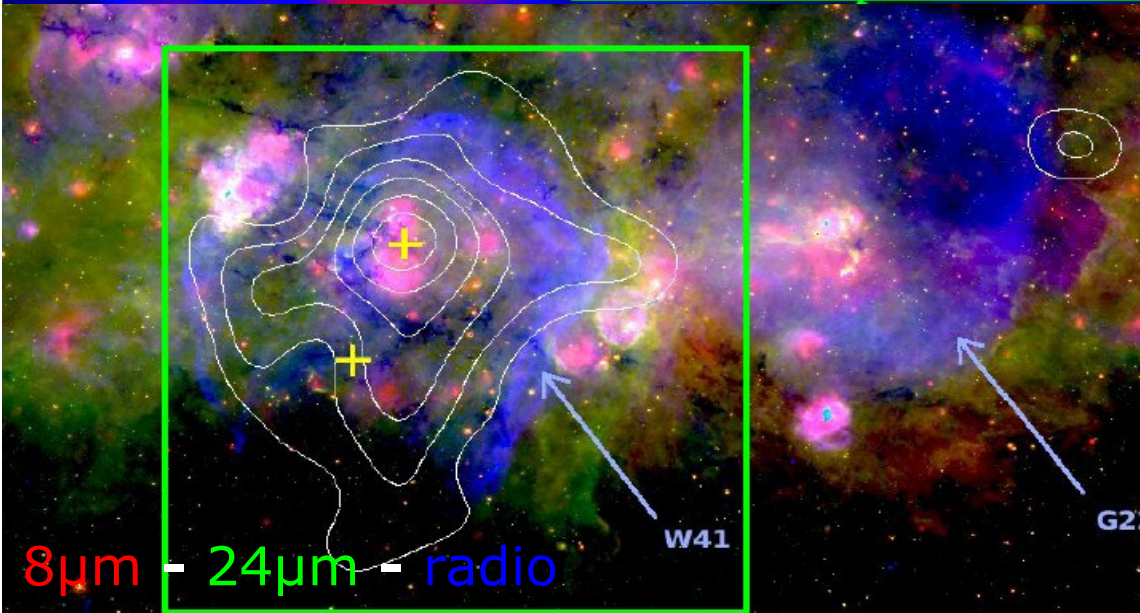
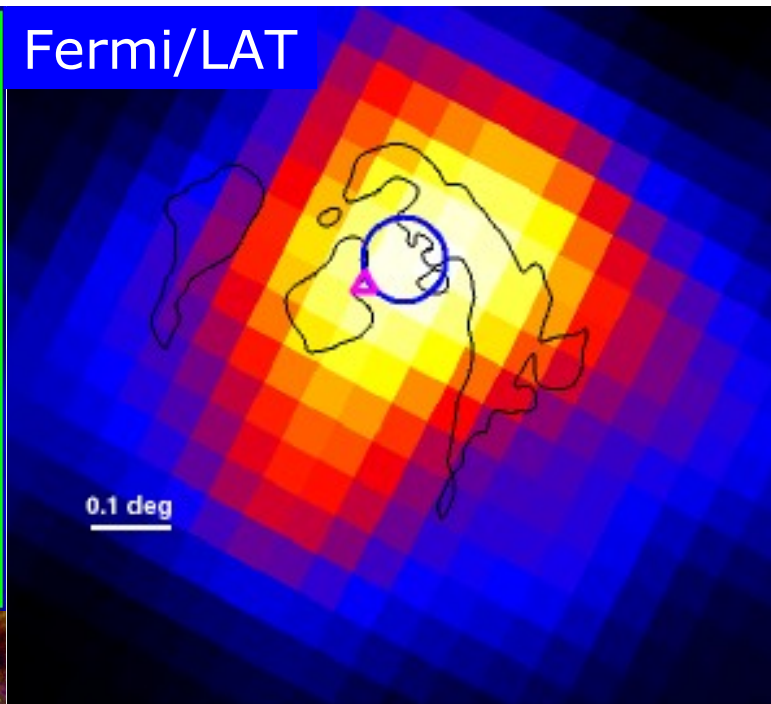
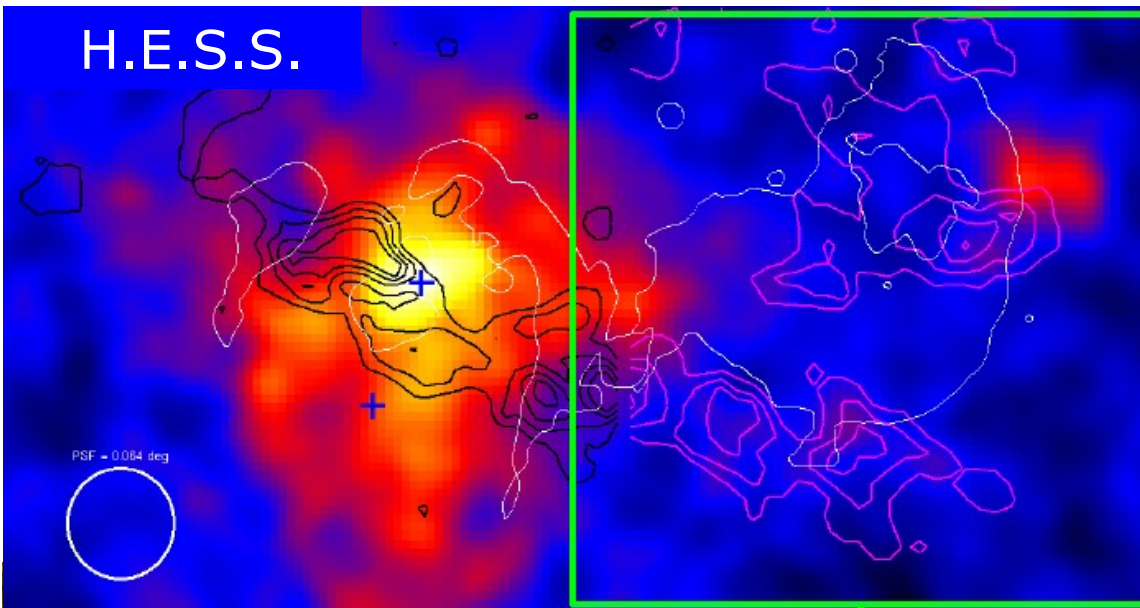
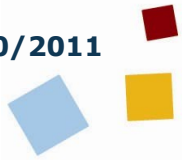
11/10/2011



Contreparties radio et X détectées, contraintes au GeV → PWN « évoluée »

SNR en interaction ou PWN ...? : Région de W41

11/10/2011



Nuage moléculaire
Candidat PWN
Nature émission GeV/TeV ?
Proposition d'obs. VLA
→ recherche de masers...

Thèse J. Méhault...
soutenance le 13/10/11 !

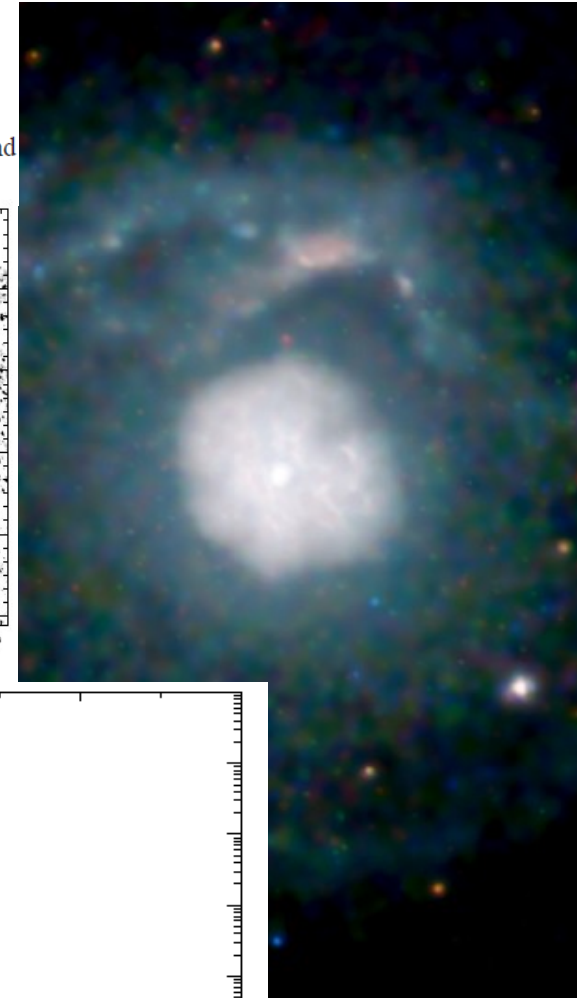
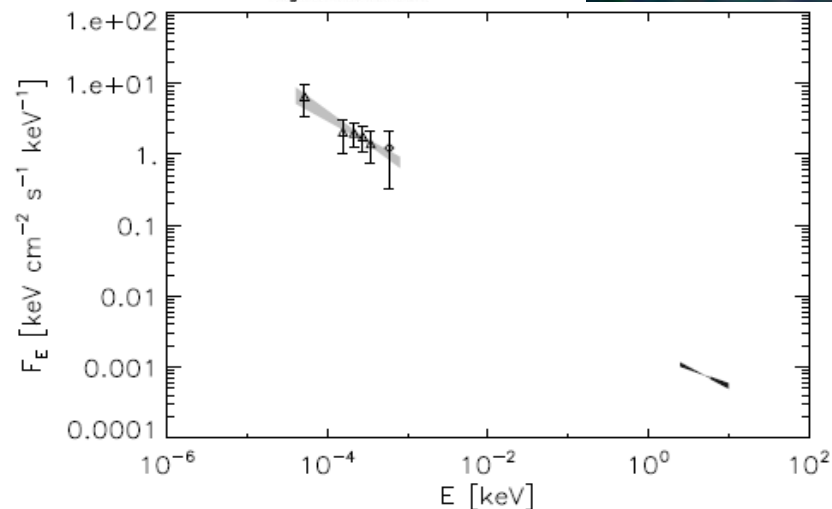
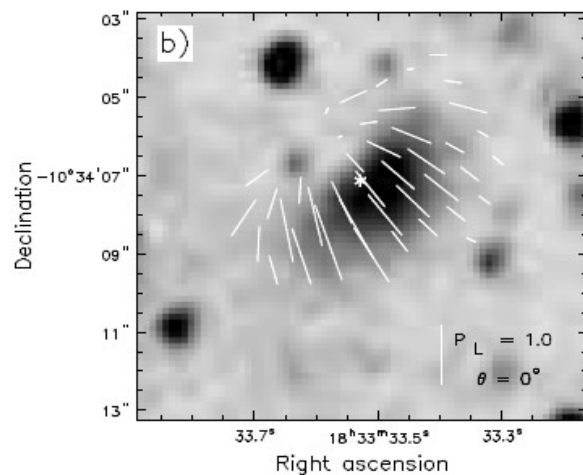
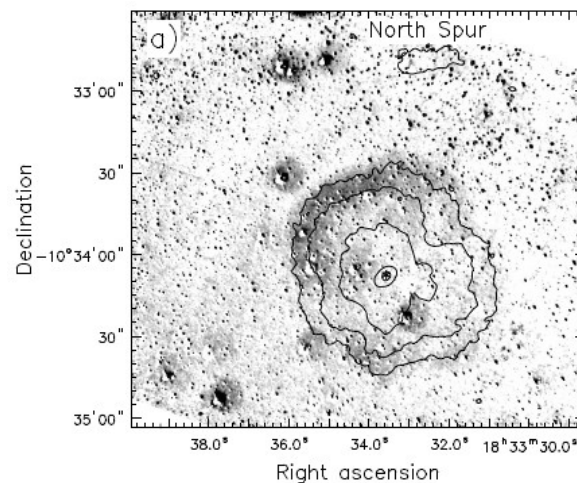
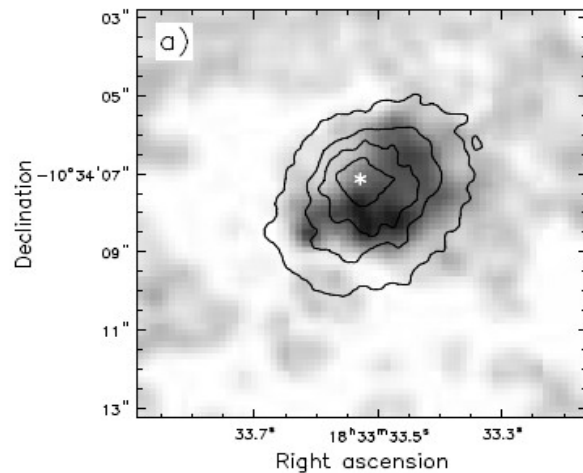
Programmes d'observations multi-longueur d'onde : radio, infra-rouge et X

11/10/2011



Infrared imaging and polarimetric observations of the pulsar wind nebula in G21.5-0.9

A. Zajczyk^{1,2,*}, Y.A. Gallant², P. Slane³, S.P. Reynolds⁴, R. Bandiera⁵, C. Gouiffès⁶, E. Le Floc'h⁶, F. Comerón⁷, and
L. Koch Miramond⁶

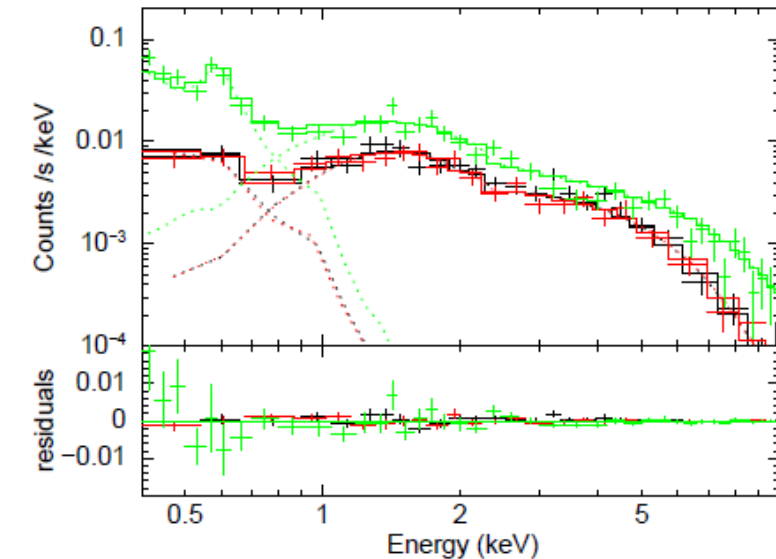
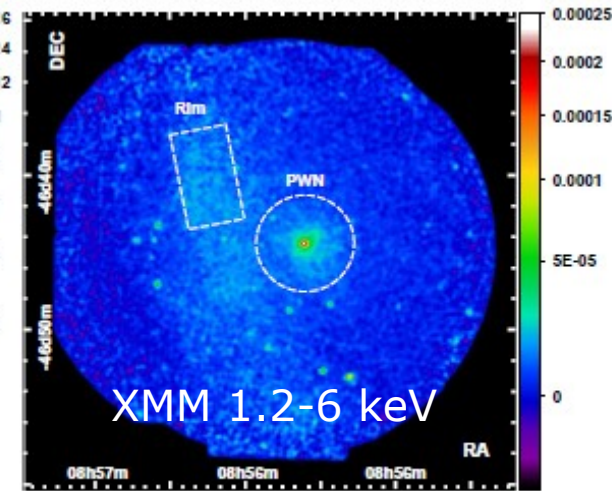
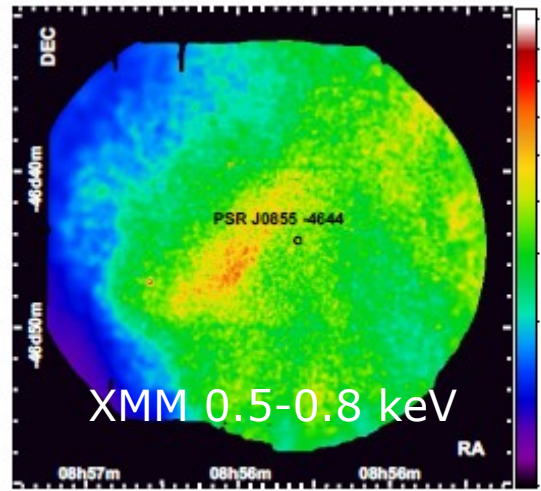
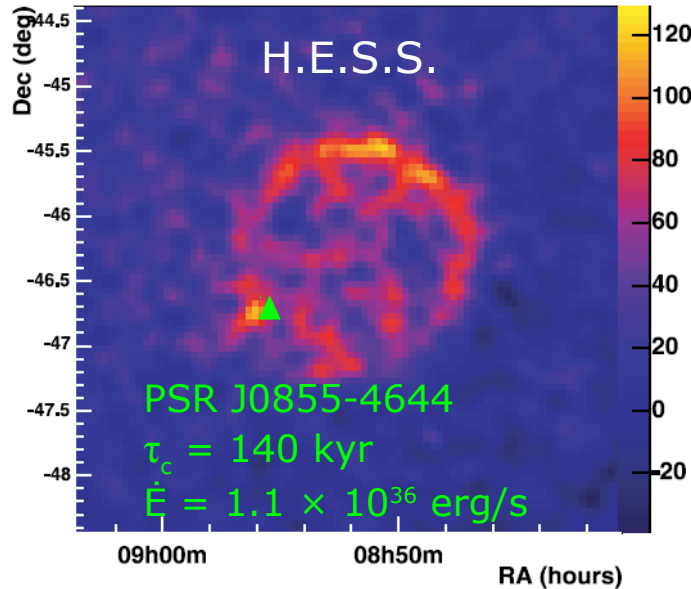


Programmes d'observations multi-longueur d'onde : radio, infra-rouge et X

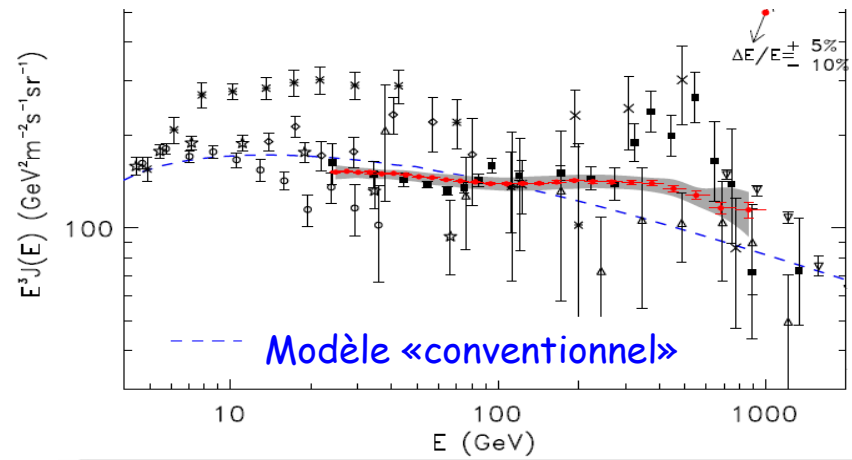
11/10/2011

A new nearby PWN overlapping the Vela Jr SNR

F. Acero¹, Y. Gallant¹, R. Terrier², M. Renaud¹ and J. Ballet³



Comparaison $N_H(X)$ et $^{12}\text{CO} \rightarrow d < 0.9$ kpc
 $\rightarrow$ proche, jeune PSR ?! $\rightarrow e^-/e^+$ cosmiques ?

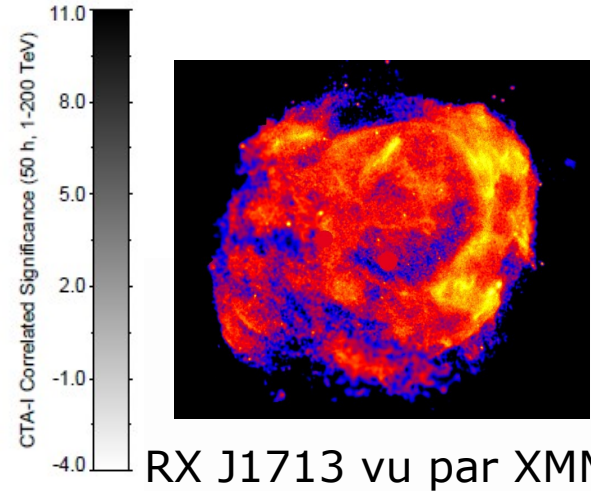
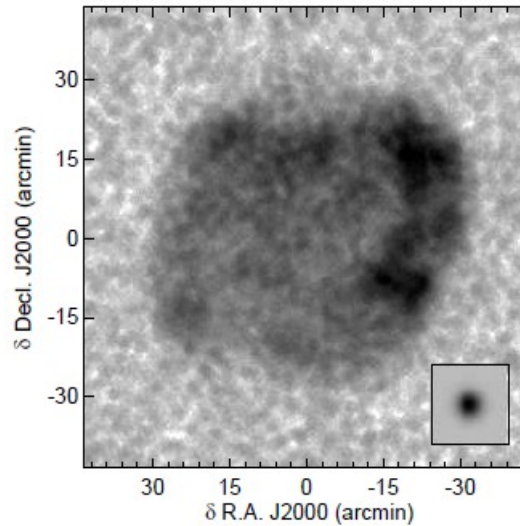
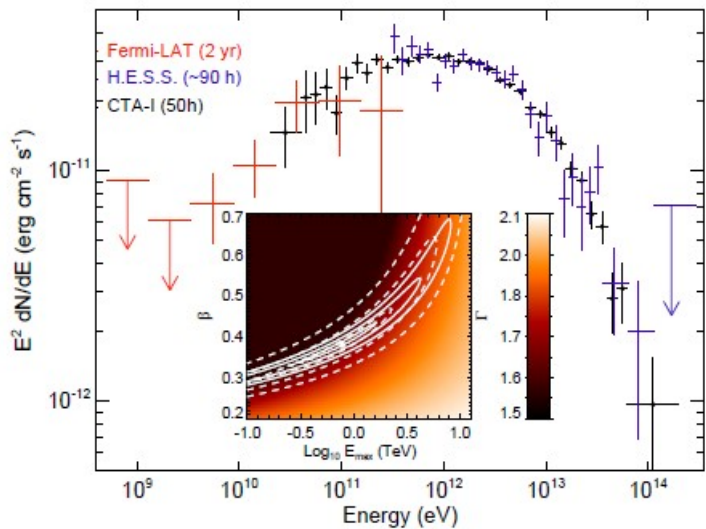


SNRs et PWNe : cas scientifique avec CTA

11/10/2011

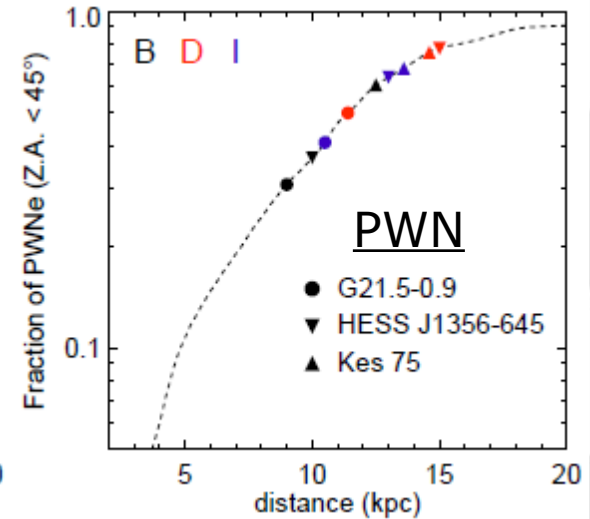
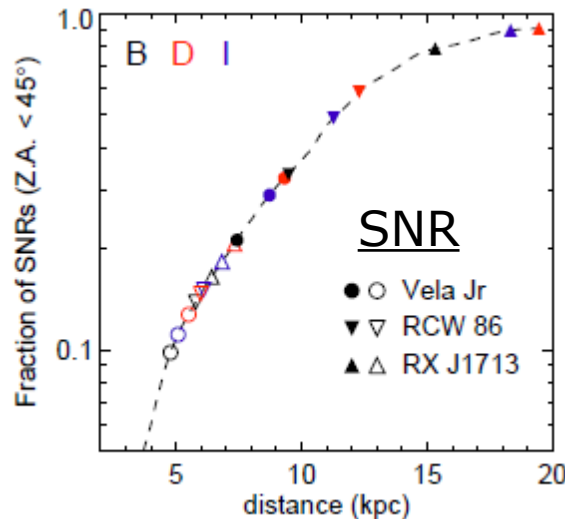
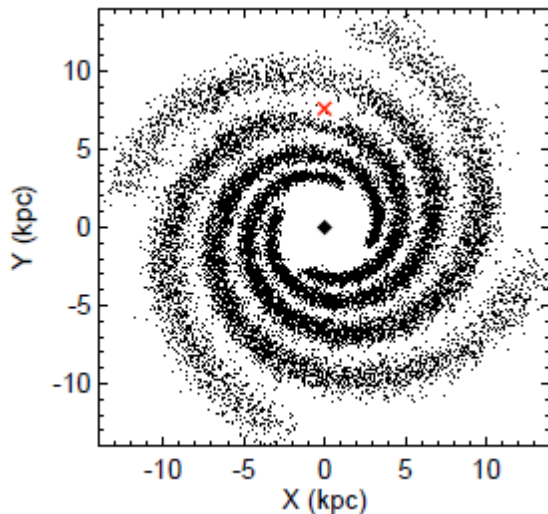


• Spectro-imagerie des SNRs brillants au TeV



RX J1713 vu par XMM

• Etudes de population (nombres de sources attendues, niveau de confusion)



SNRs et PWNe : cas scientifique avec CTA

11/10/2011

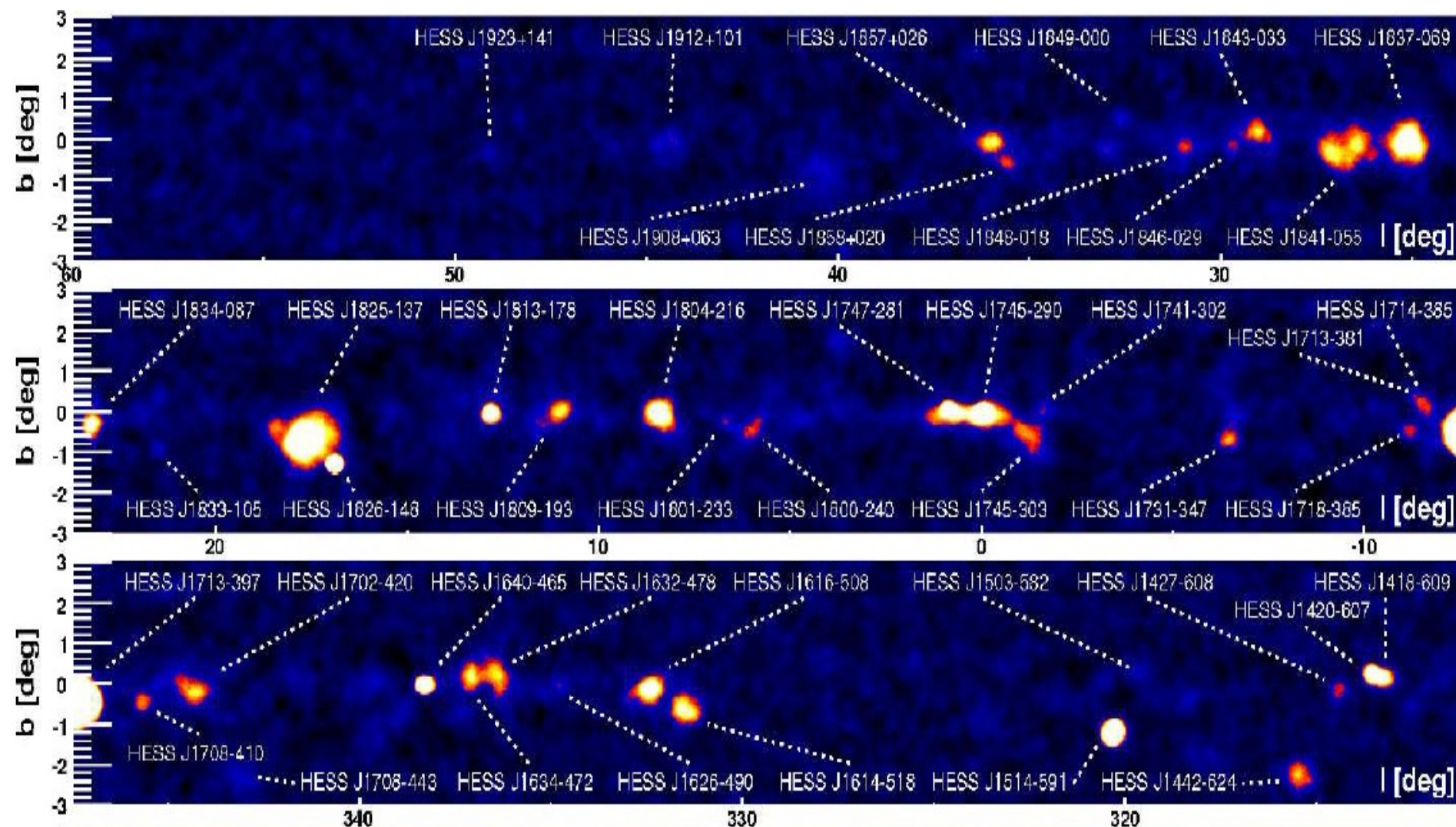


Image H.E.S.S. des régions centrales
de la Galaxie (2004 – 2009)

SNRs et PWNe : cas scientifique avec CTA

11/10/2011

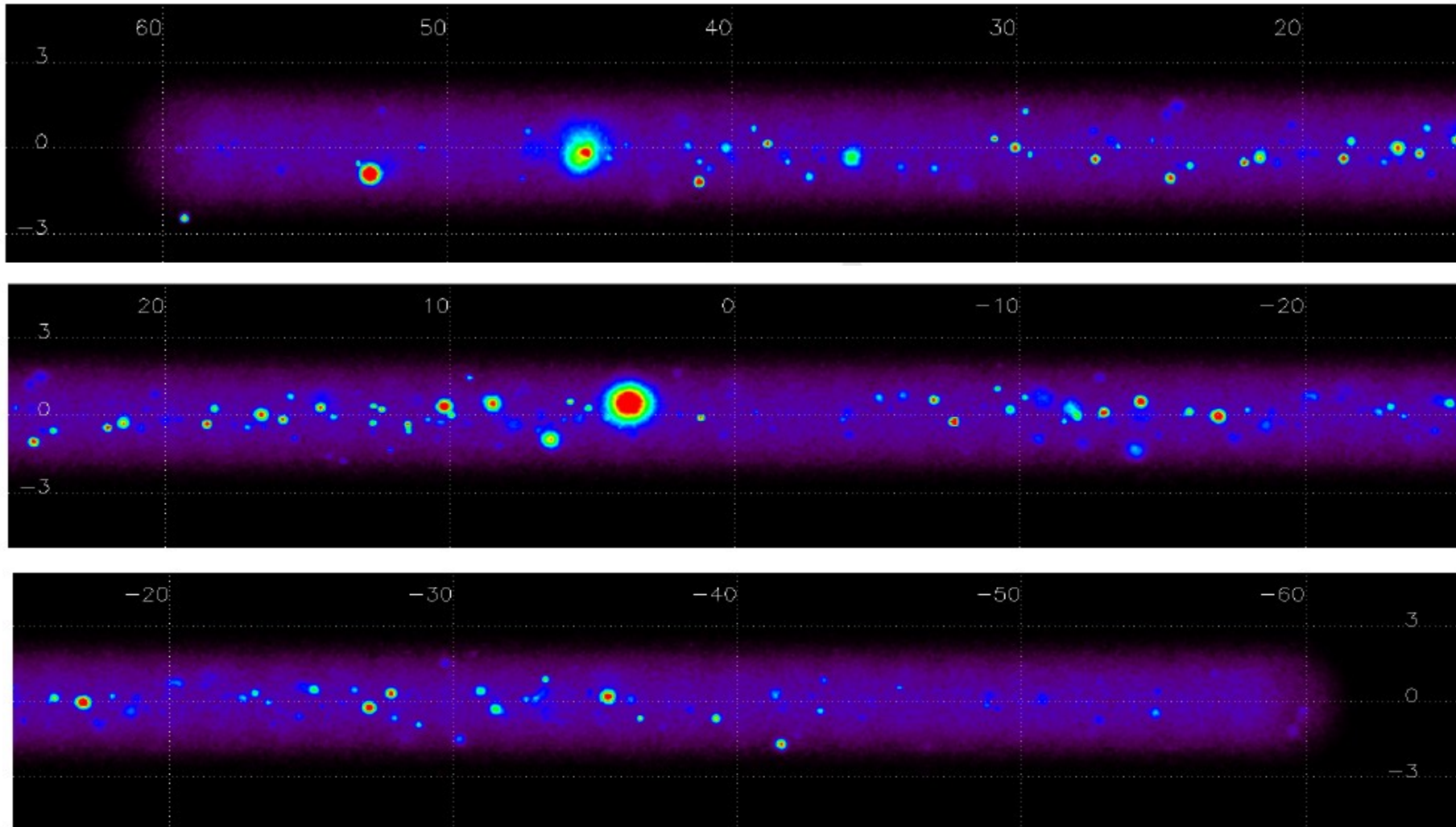
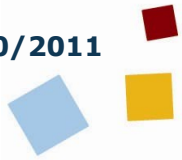


Image *simulée* CTA des régions centrales
de la Galaxie ($\sim 2\text{-}3$ ans d'observation)