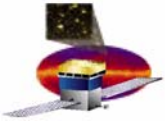


Status and issues for the LAT interstellar emission model

S. W. Digel
Stanford Linear Accelerator Center



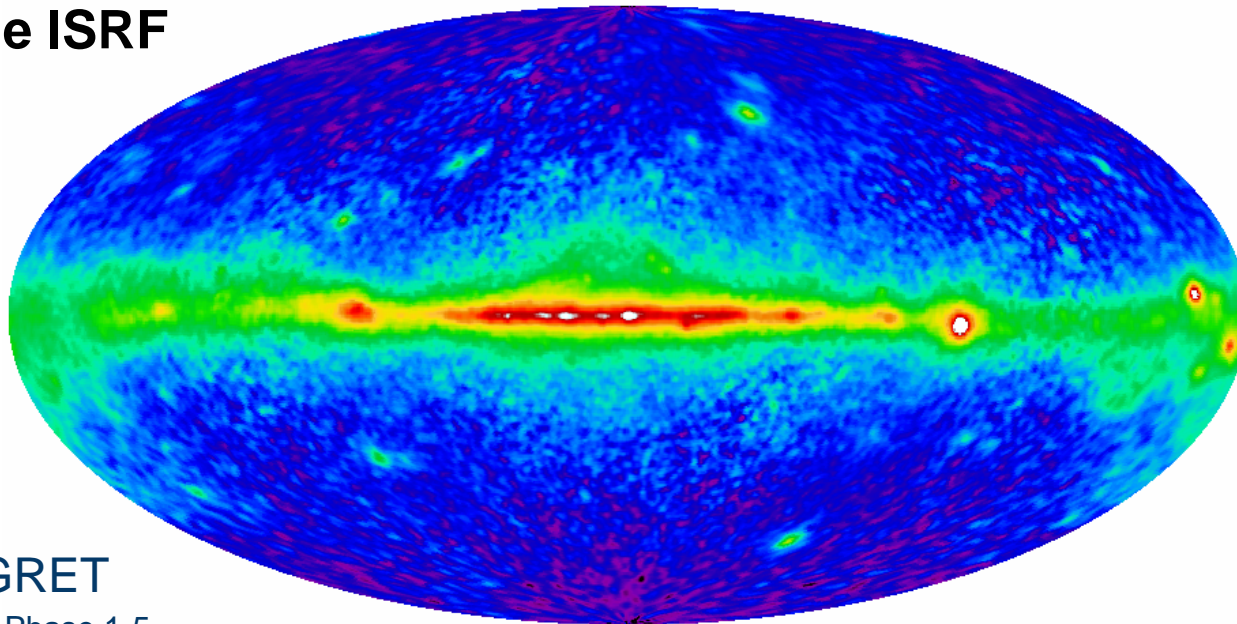
Outline

- **Update from our last in-person meeting (September 2004)**
 - **What is new**
 - **Concept of the diffuse emission model**
- **Goals for the workshop in terms of modeling the diffuse emission**
 - **Resolving issues, of course**
 - **Other goals include pre-launch paper topics**
- **Milestones**
 - **Science Tools Checkout 3 ('Extended')**
 - **DC2 and beyond**



[Recycled] Why a model is needed

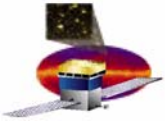
- Limited angular resolution, limited γ -ray statistics, and relatively bright, structured interstellar emission
- Errors in model translate to false detections or bad positions
- At higher $|b|$, a good model is required for study of the extragalactic (isotropic) component
- And of course you might learn something about CRs, ISM, and the ISRF



~60% of EGRET γ -rays were diffuse emission from the Milky Way (~30% isotropic emission, and ~10% from detected point sources)

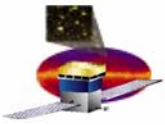
EGRET

>100 MeV, Phase 1-5



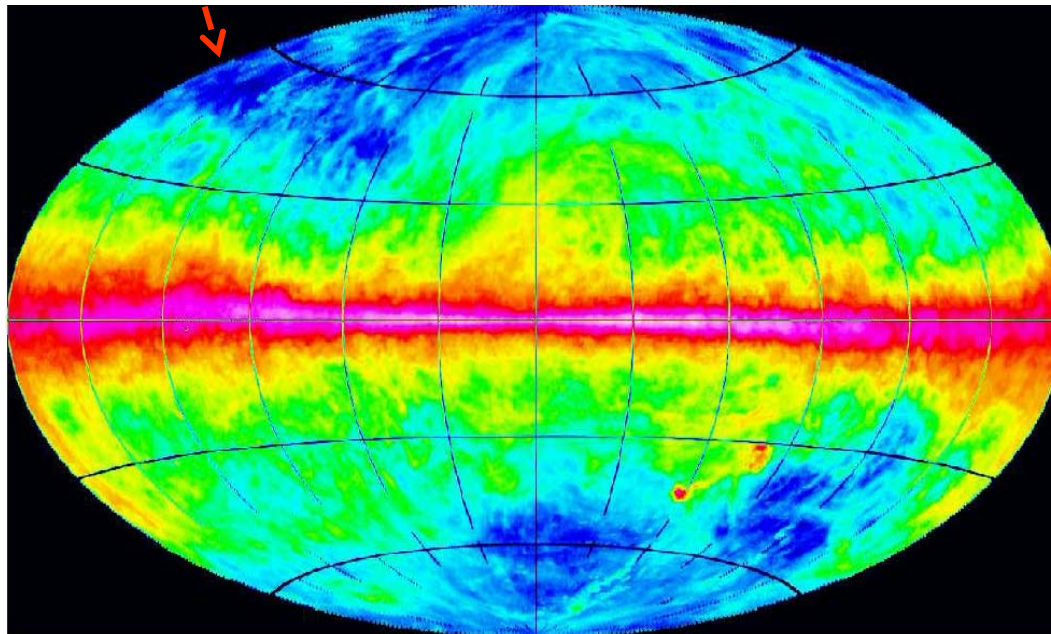
What's new

- **Collaboration science working groups have been chartered and are showing signs of life**
 - **Most CSWGs are at the stage of discussing lists of publications to be prepared before launch. We have to do that, too, but we also have a focus for our efforts.**
- **For observation simulation and likelihood analysis we now have the MapCube source (by Jim Chiang) for specifying a diffuse emission model in as much detail as anyone could want**



What's new (2)

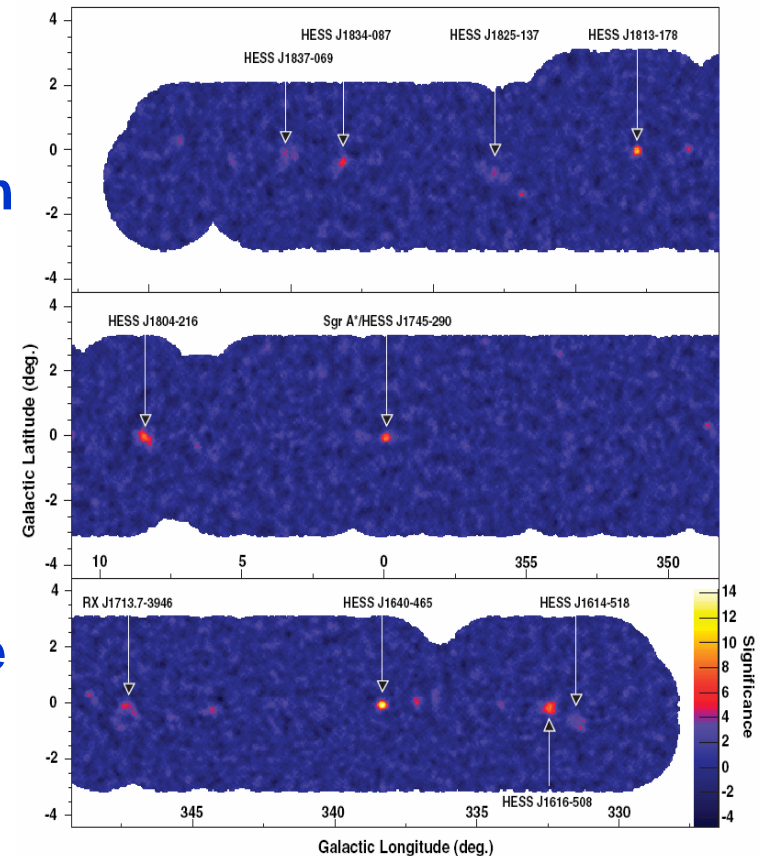
- The best-yet composite H I survey of the sky has been released (although it is not yet available on Vizier) Leiden/Argentine/Bonn (Kalberla et al. 2005)
- Other developments – *new CO surveys, evidence for 'dark' molecular gas, a new model for the ISRF, work on GALPROP, and new γ -ray production functions* – will be discussed in the rest of this session





What's new elsewhere

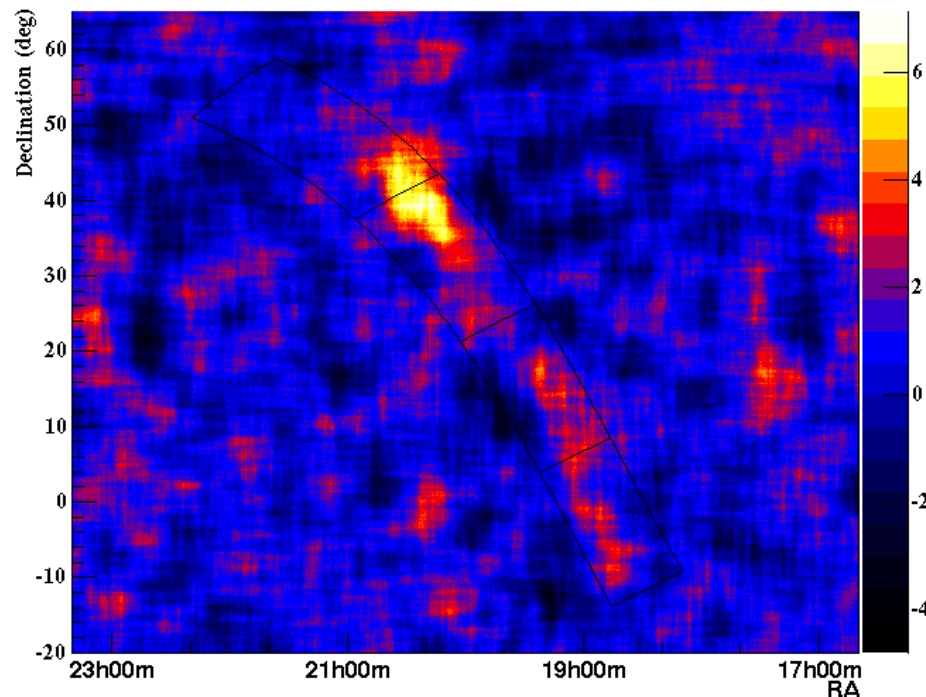
- **HESS Galactic plane survey sees many extended TeV sources (Aharonian et al. 2005)**
 - This might possibly inform a detailed model of the distribution of CR sources, although the distribution is so confined to the plane that the sources (probably plerions and SNR) are at least several kpc distant
 - I expect that HESS will start optimizing cuts to look at diffuse emission as well



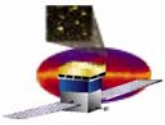


What's new elsewhere (2)

- Milagro reports detecting the diffuse emission of the Milky Way at >1 TeV energies (Atkins et al. 2005)
 - To the extent that they are not seeing unresolved point sources, the result should constrain the LAT interstellar emission model

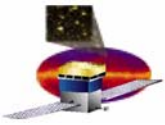


Milagro (Andy Smith)



(My) Current concept for the model

- For optimizing the model, we'll may want to keep the contributions from IC emission, bremsstrahlung, and pion decay as separate terms in a model – or at least keep pion decay separate from CR electron terms
 - What does optimize mean? To first approximation it means adjusting the amplitudes of the terms separately (and consistently) to maximize the agreement with LAT (or EGRET) data after point sources have been taken into account
 - Other optimizations involve resolving distance ambiguities for interstellar gas
 - Still another optimization that could be possible – but is operationally hardest for me to imagine – is placing specific CR sources for a 3-dimensional GALPROP calculation
- For the model that we distribute, I do not expect that we will need adjustable parameters – maybe I am naïve



Current issues (for splinter sessions)

- ***Overall distribution of gas and light in the Galaxy*** (Tuesday, 9:30-12:30)
 - Can we resolve kinematic distance ambiguities sufficiently well to make it worth doing?
 - How will we incorporate the ‘dark’ molecular gas, how will we deal with cold atomic hydrogen (seen in self absorption) and determining $N(\text{H I})$ in general, and how significant are the dark and cold components relative to the ISM traced by CO and H I emission.
 - Modeling the interstellar medium toward the Galactic center and anticenter
- **Other topics**
 - What angular resolution is appropriate for the diffuse emission model?
 - Pre-launch paper topics
 - Schedule, who does what...



Current issues (2)

- ***Using GALPROP for GLAST*** (Tuesday, 1:30-3:00 pm)
 - The GALPROP-SAE interface – what gets passed from GALPROP to the science tools as the model or the components of the model
 - Analysis methods (or scenarios) for the diffuse emission itself...
- ***Extragalactic diffuse emission*** (Tuesday, 2:00-4:30 pm)
 - ...and for the extragalactic diffuse
 - Review of constraints from EGRET about the luminosity function of blazars would be useful for planning simulations, e.g., for DC2 or for studying how well the background will be resolved



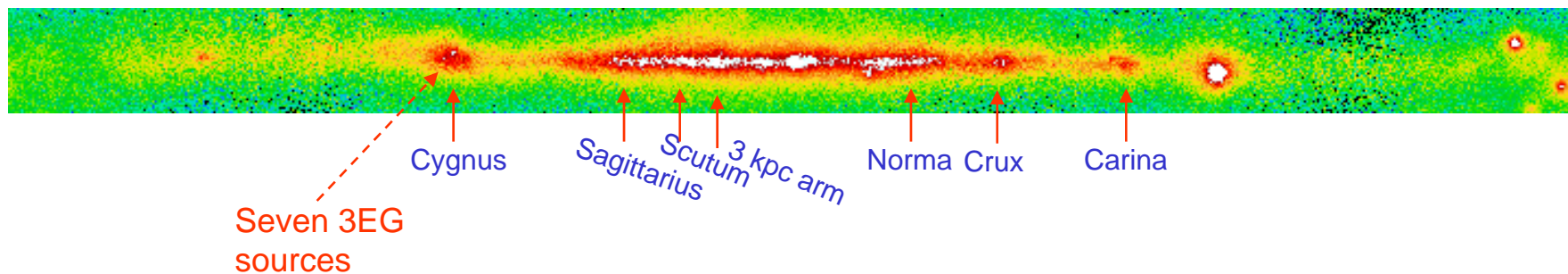
Milestones

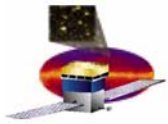
- **Near term, project-level:**
 - **Science Tools Checkout 3 [already discussed by Julie] – *September 2005***
 - **Data Challenge 2 [also already discussed] – *January 2006***
- **What activities need to be synchronized with these**
 - **Integrating the various components of the diffuse emission model for analysis of point sources & for study of the model itself**
 - **Preparing useful sky model and alternate for DC2**
 - **What aspects will be feasible for Checkout 3 and what will wait for DC2?**



Future (post-DC2)

- **Supporting observations:** Special regions of the sky or special molecular lines; this is in principle part of the Multiwavelength Observation plan for the collaboration
- This kind of survey work is best carried out with dedicated telescopes of moderate angular resolution
 - The CfA 1.2-m and NANTEN (Nagoya) 4-m millimeter-wave groups (at least) are interested in collaborations, but details have not been discussed (which would transcend our working group), and as yet no funding is available from the LAT side to support multiwavelength observations
 - Tangent directions of spiral arms and GC





Backup slides follow



Future (2)

- **High-latitude clouds - small but detectable as LAT point sources are being found in an unbiased intermediate-latitude survey (Dame et al.) – Torres et al. (2005)**

