

Présentation du projet de travail collectif du GDR ACCORT pour l'intercomparaison de modèles de transferts radiatifs

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- **inter-comparaisons de modèles**
 - **précision**
 - **temps**
- **dynamique**



- - configurations

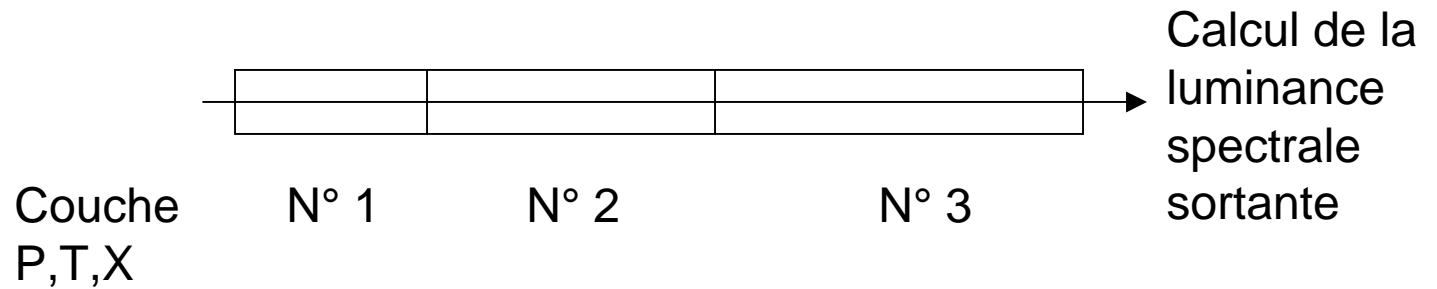
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- identiques

- intérêts



corrélations spectrales



Modèles de transferts radiatifs : forces et faiblesses

LABORATOIRE
PROCÉDÉS, MATÉRIAUX
et ENERGIE SOLAIRE
UPR 8521 du CNRS.
conventionnée avec
l'université de Perpignan
PROCESSES, MATERIALS
and SOLAR ENERGY
LABORATORY





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$$\rho c_v \left(\frac{\partial T}{\partial t} + \mathbf{v} \cdot \nabla T \right) = -\nabla \cdot \left(\underbrace{-k \nabla T}_{\text{conduction}} + \underbrace{\mathbf{q}_R}_{\text{radiation}} \right) - p \nabla \cdot \mathbf{v} + \mu \Phi + \dot{Q}'''$$

$$\nabla \cdot \mathbf{q}_R = \kappa_\lambda [4\pi i_{\lambda b}(\tau_\lambda) - G(\tau_\lambda)] \quad G(\tau_\lambda) = \int_{\phi=0}^{2\pi} \int_{\theta=0}^{\pi} i(\tau_\lambda, \theta, \phi) \sin \theta \, d\theta \, d\phi$$

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$$\frac{di(\tau_\lambda, \theta, \phi)}{d\tau} + i(\tau_\lambda, \theta, \phi) = (1 - \omega) i_{\lambda b}(\tau_\lambda) + \left(\frac{\omega}{4\pi} \right) \int_{\phi=0}^{2\pi} \int_{\theta=0}^{\pi} i(\tau_\lambda, \theta', \phi') p((\theta', \phi') \rightarrow (\theta, \phi)) \sin \theta' \, d\theta' \, d\phi'$$



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- ***solutions exactes***
- **hypothèses simplificatrices**
- **solutions de référence**

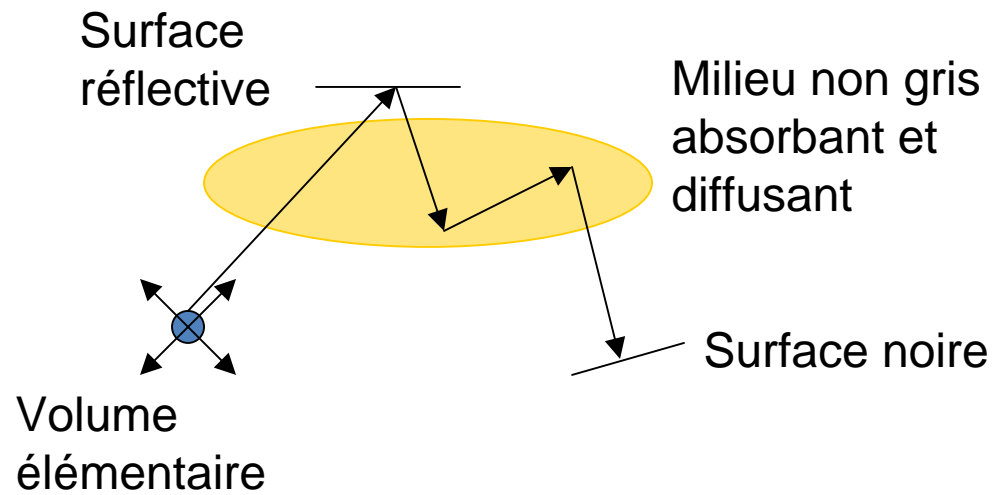


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N paquets de photons





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 - milieu anisotropiquement dépendantes de T
 - non gris
 - géométries complexes
 - précision solutions de référence
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 - Temps de calcul élevé
 - Fluctuation statistique



- **Discrétisation du domaine spatial**

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- **Discrétisation du domaine angulaire**

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 - Pre-calcul

transferts couplés

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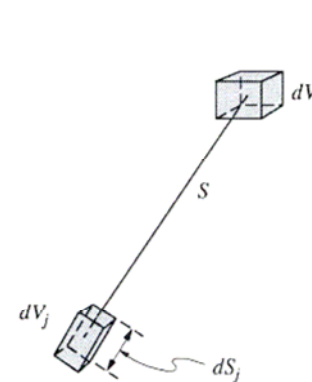
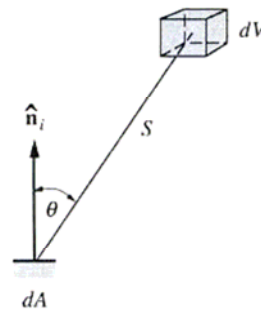
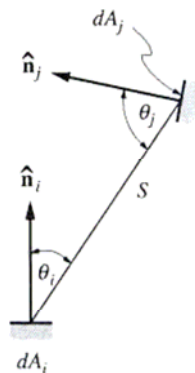
 - Temps de calcul élevé

- non-gris
- diffusion
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anisotrope

fonction

température





- $$i(x, y, z, \theta, \phi) = A_0 + \sum_{n=1}^N [\zeta^n A_{n,x} + \eta^n A_{n,y} + \mu^n A_{n,z}]$$

- $$E_m(x) \cong \sum_{n=1}^N w_n \mu_n^{m-2} e^{-x/\mu_n}$$

- $$I(\mathbf{r}, \hat{\mathbf{s}}) = \sum_{l=0}^{\infty} \sum_{m=-l}^l I_l^m(\mathbf{r}) (-1)^{(m+|m|)/2} \left[\frac{(l-|m|)!}{(l+|m|)!} \right]^{1/2} e^{im\psi} P_l^{|m|}(\cos \theta)$$

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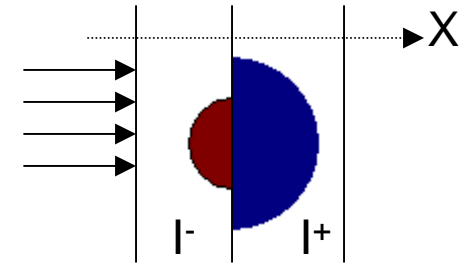
$$\mathbf{q} = - \frac{16n^2\sigma T^3}{3\beta_R} \nabla T$$



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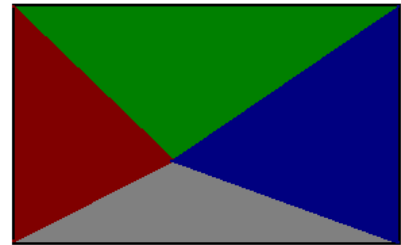
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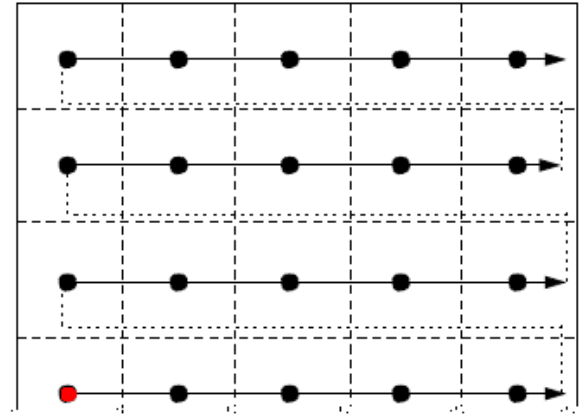
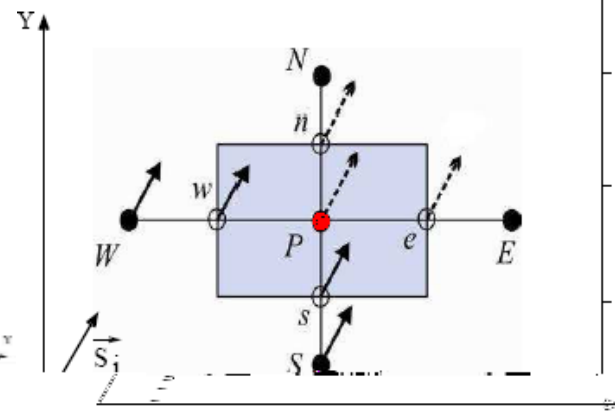
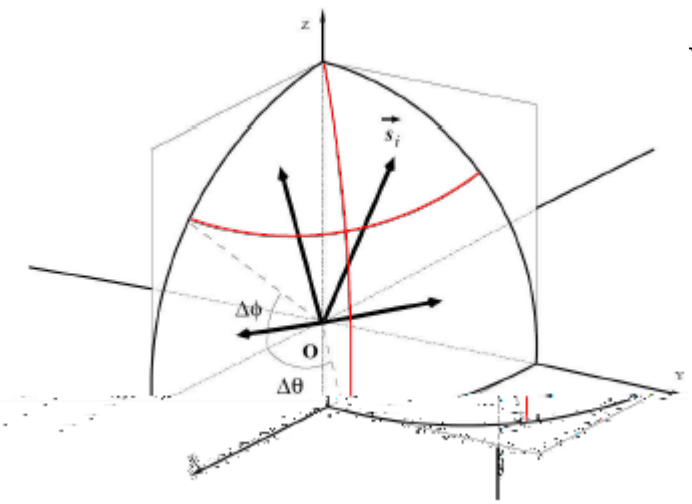
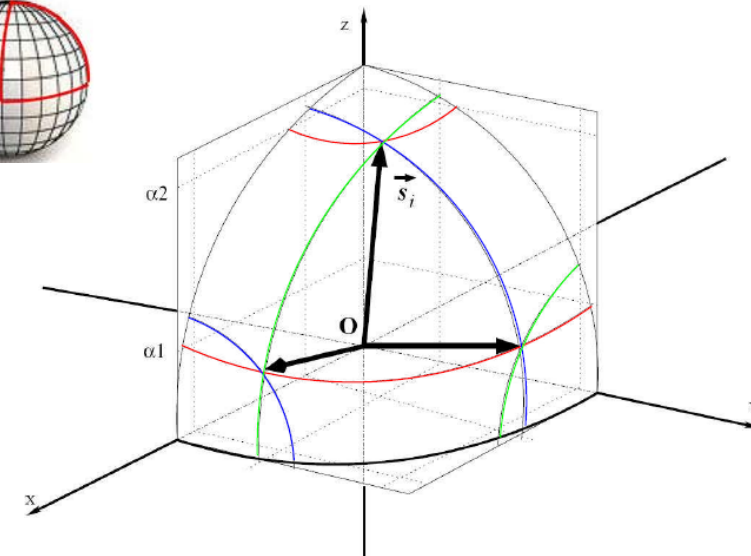
quadratures numériques

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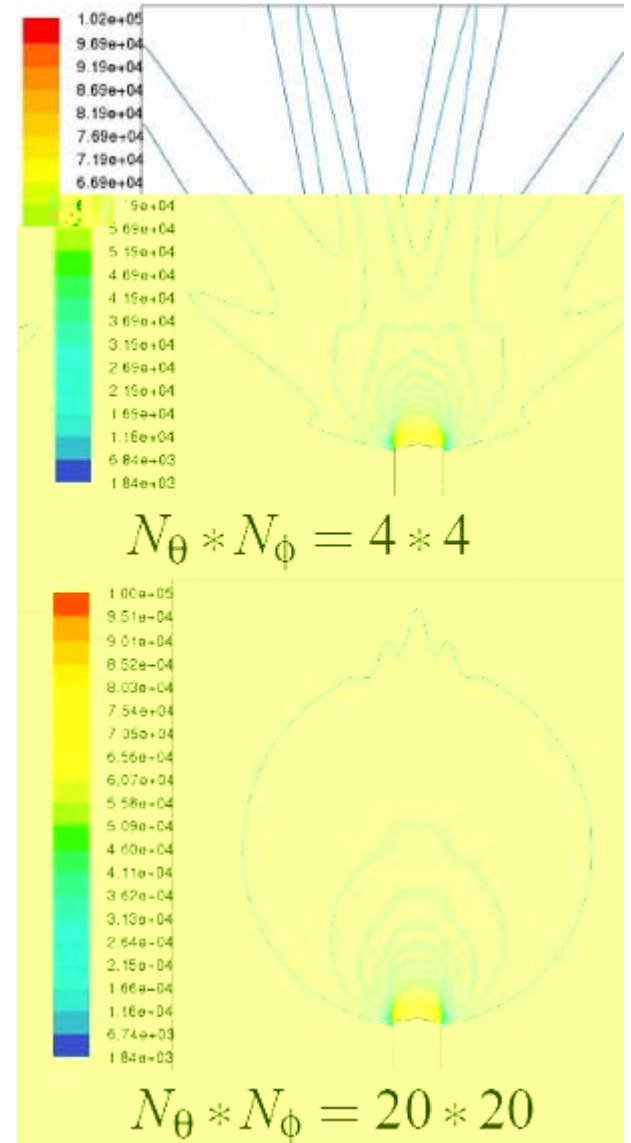
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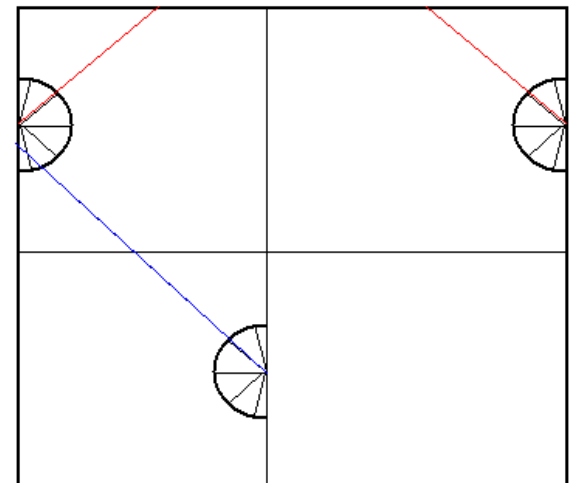
$$q^- = \sum i_w^-(\theta, \phi) \cos \theta \sin \theta \Delta \theta \Delta \phi$$

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$$i_{n+1} = i_n \exp(-\kappa \Delta s) + \frac{\kappa \sigma T_c^4}{\pi} (1 - \exp(-\kappa \Delta s)).$$

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$$q_+ = (1 - \varepsilon) q_- + \varepsilon E_s$$





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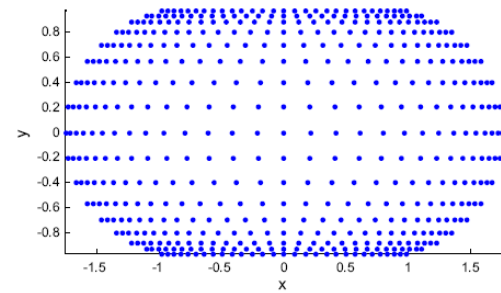
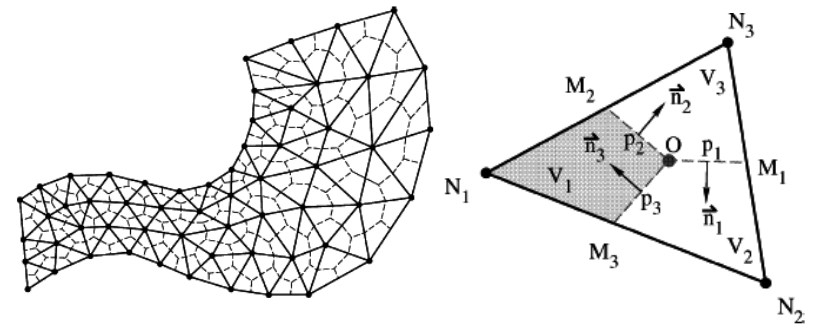
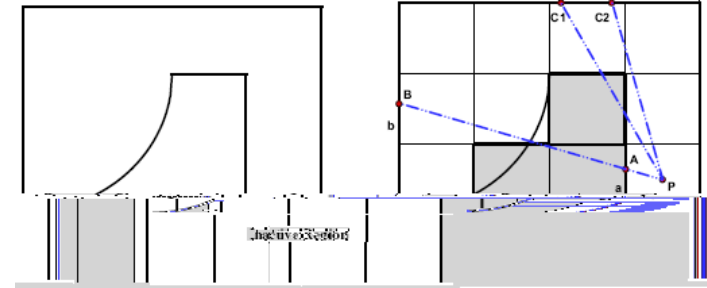
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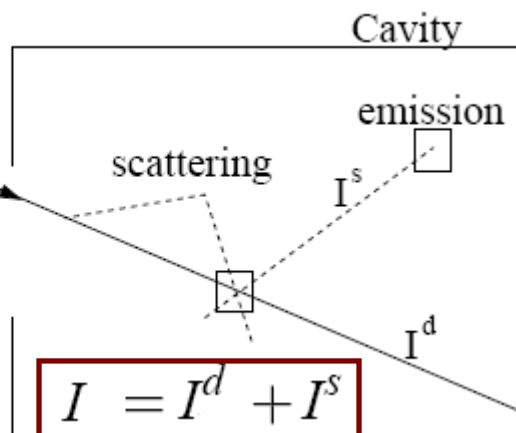
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Collimated radiation



$$\vec{s}_i \cdot \vec{\nabla} I^d = -\beta I^d$$

$$I^d = I_0^d \exp \left[-\beta |\vec{r} - \vec{r}_w| \right]$$

$$\vec{s}_i \cdot \vec{\nabla} I^s = -\beta I^s + S^s$$

$$S^s = \kappa_a I_b + \kappa_s \int_{4\pi} \left(I^d + I^s \right) P(\vec{r}, \vec{s}_j \rightarrow \vec{s}_i) d\Omega_j$$

$$S^s = \kappa_a I_b + \kappa_s \int_{4\pi} I^s P(\vec{r}, \vec{s}_j \rightarrow \vec{s}_i) d\Omega_j$$

$$+ \kappa_s \int_{A_w} I_0^d \exp[-\beta_v |\vec{r} - \vec{r}_w|] P(\vec{r}, \vec{s}_j \rightarrow \vec{s}_i) \frac{\vec{n}_w \cdot \vec{s}_i}{\|\vec{r} - \vec{r}_w\|^2} dA_w$$

