



UNIVERSITÉ
PARIS-SUD 11



Lyon 1

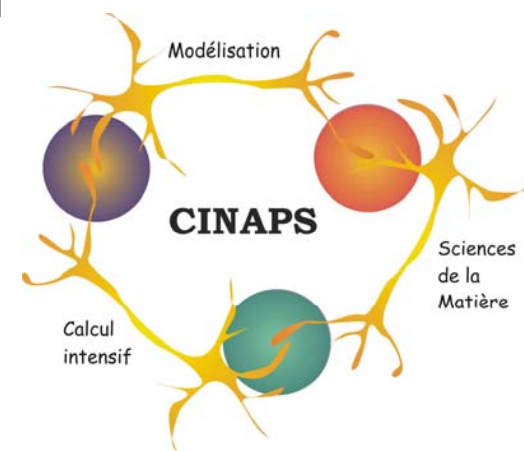
Etude multi-échelles d'une cinétique de vieillissement d'un dépôt

Emile Maras, M2

encadré par : Isabelle Braems,
Fabienne Berthier, Bernard Legrand

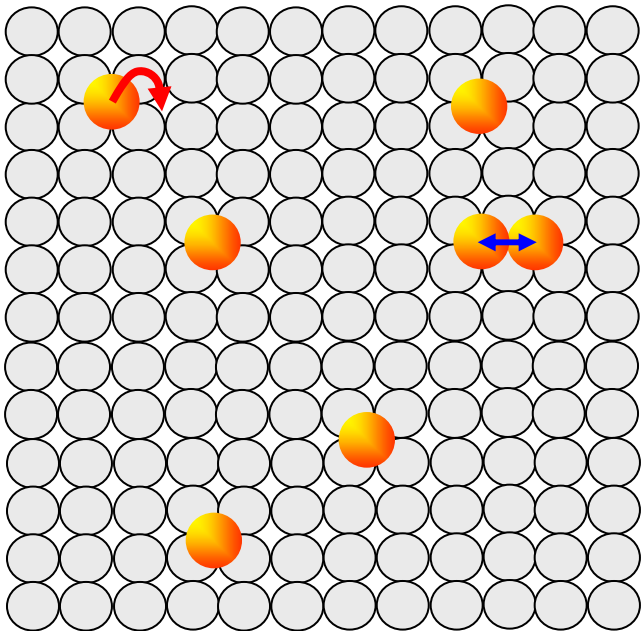
Agence Nationale de la Recherche
ANR

Lemhe



Pourquoi?

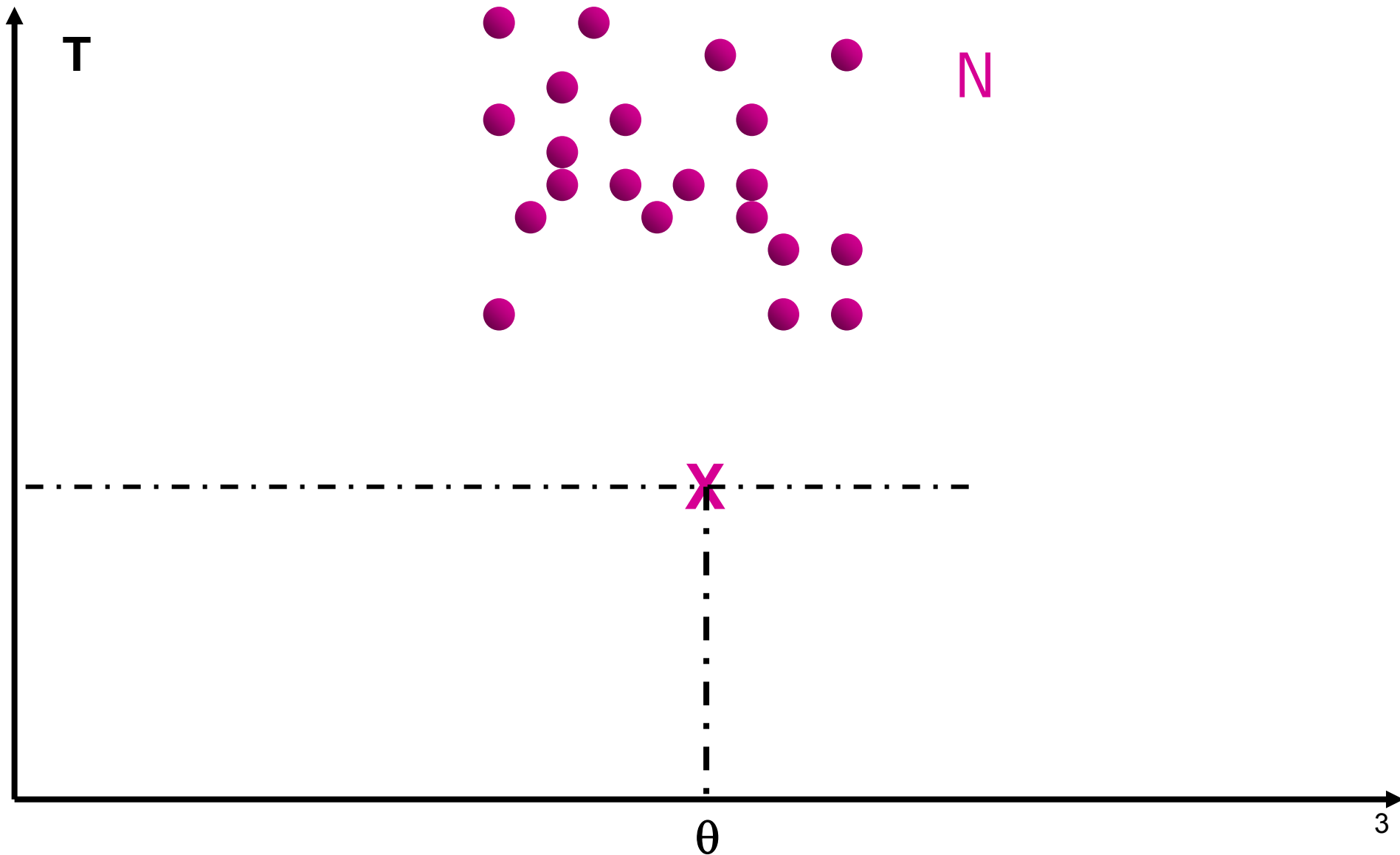
- Durée de vie des couches minces électroniques
 - En sollicitation
 - En crise



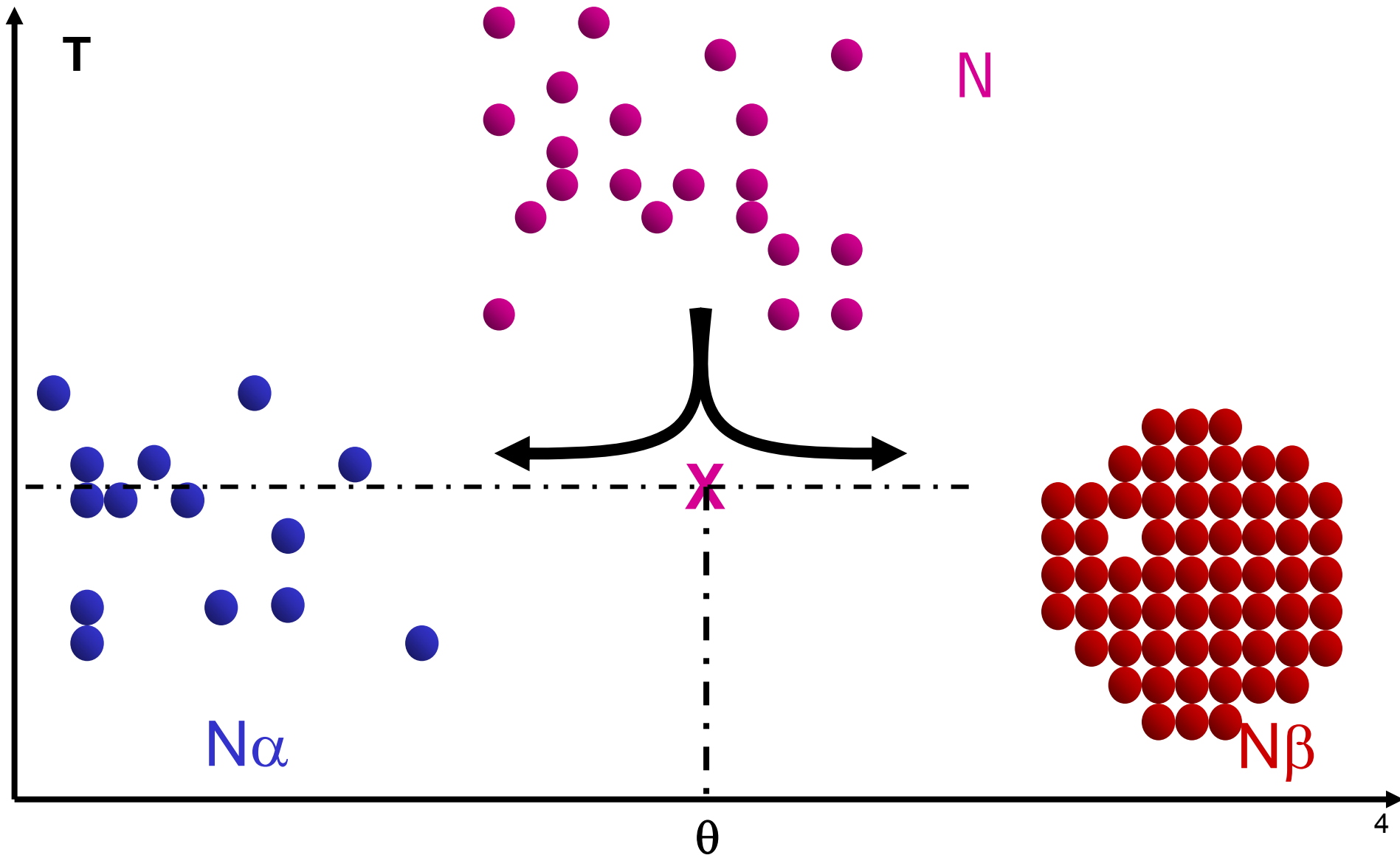
Réseau rigide, cfc(001)
Diffusion superficielle

Système=monocouche A-L

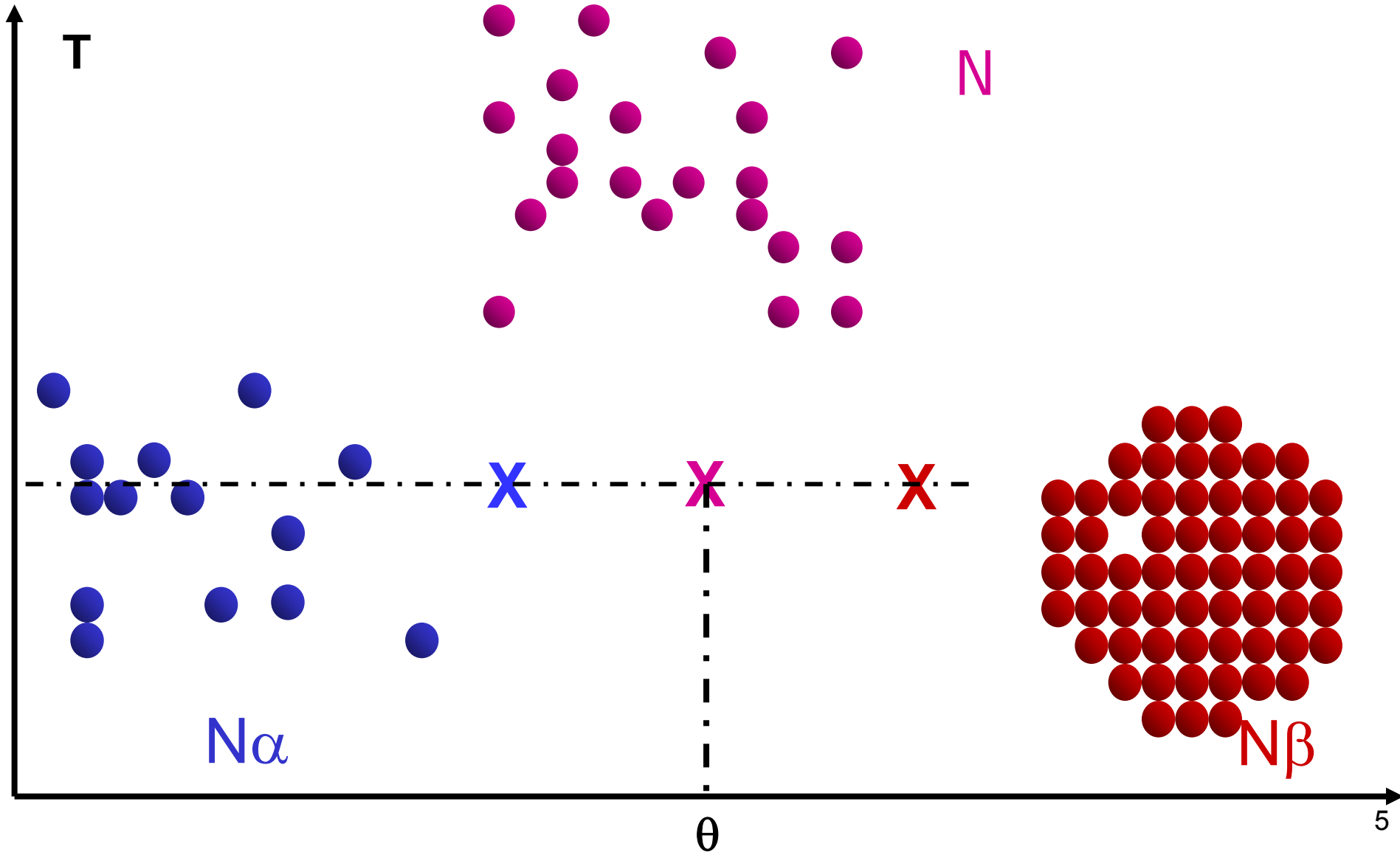
Une solution solide hors-équilibre



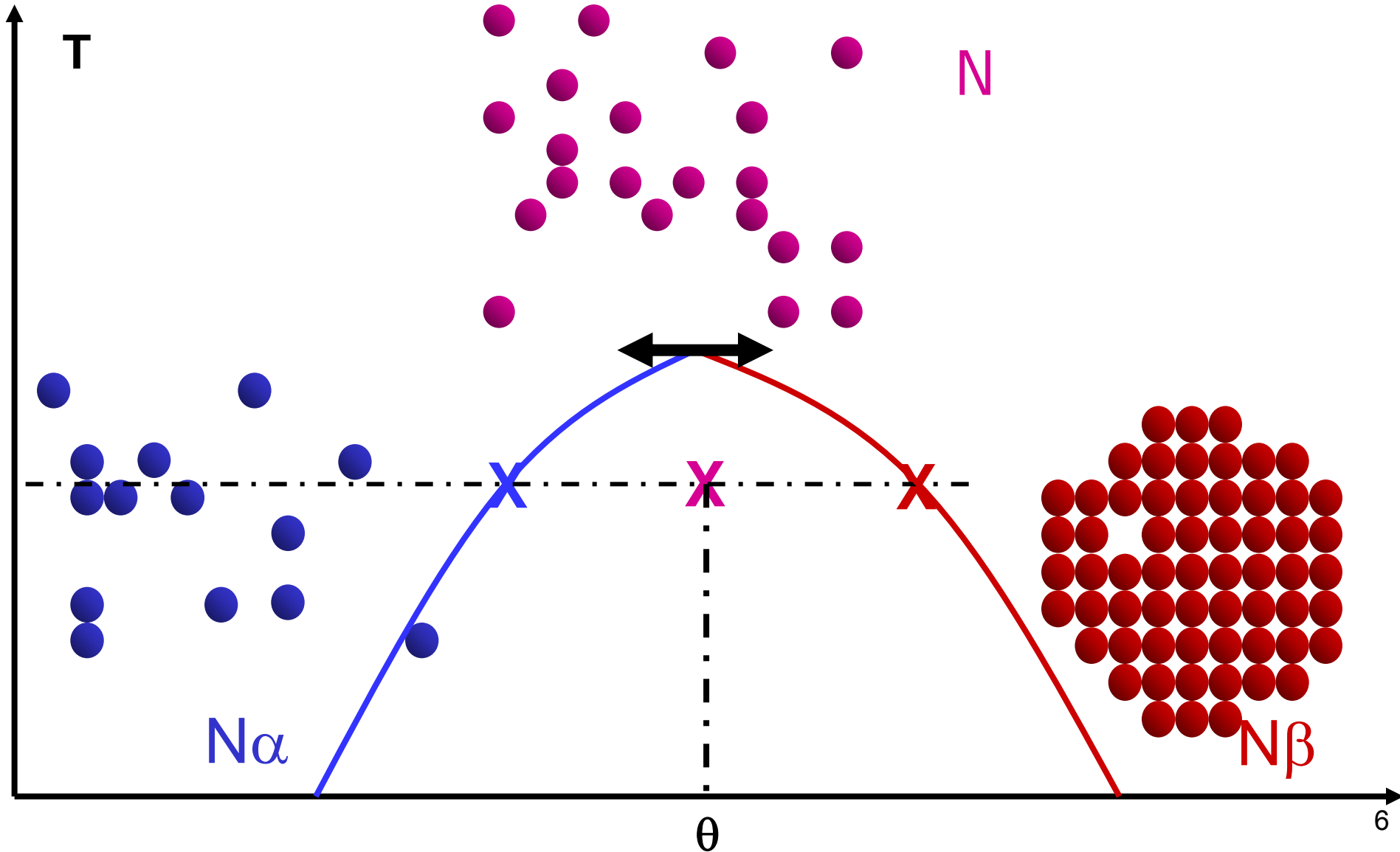
Une solution solide hors-équilibre



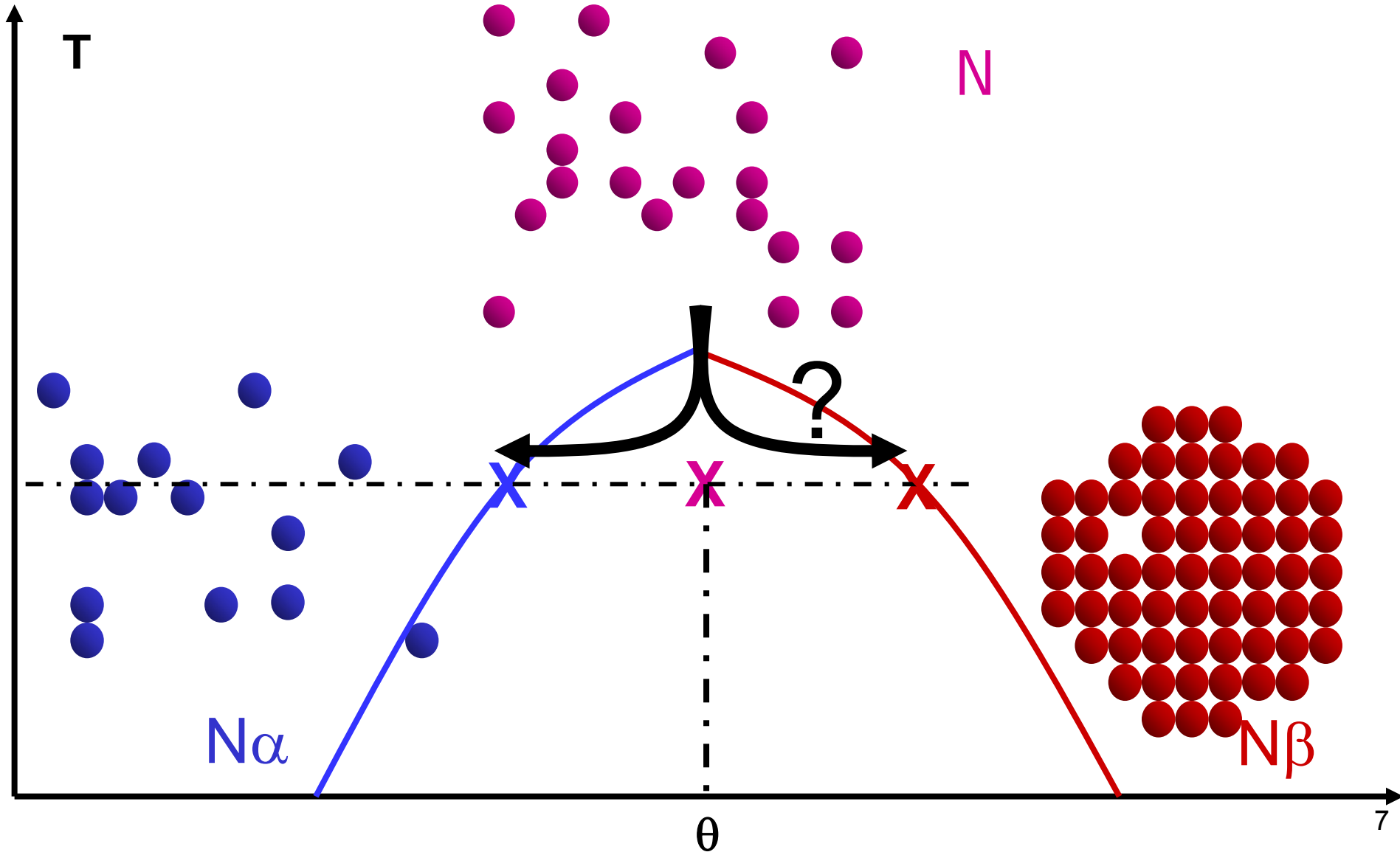
Deux phases coexistent



Deux phases coexistent



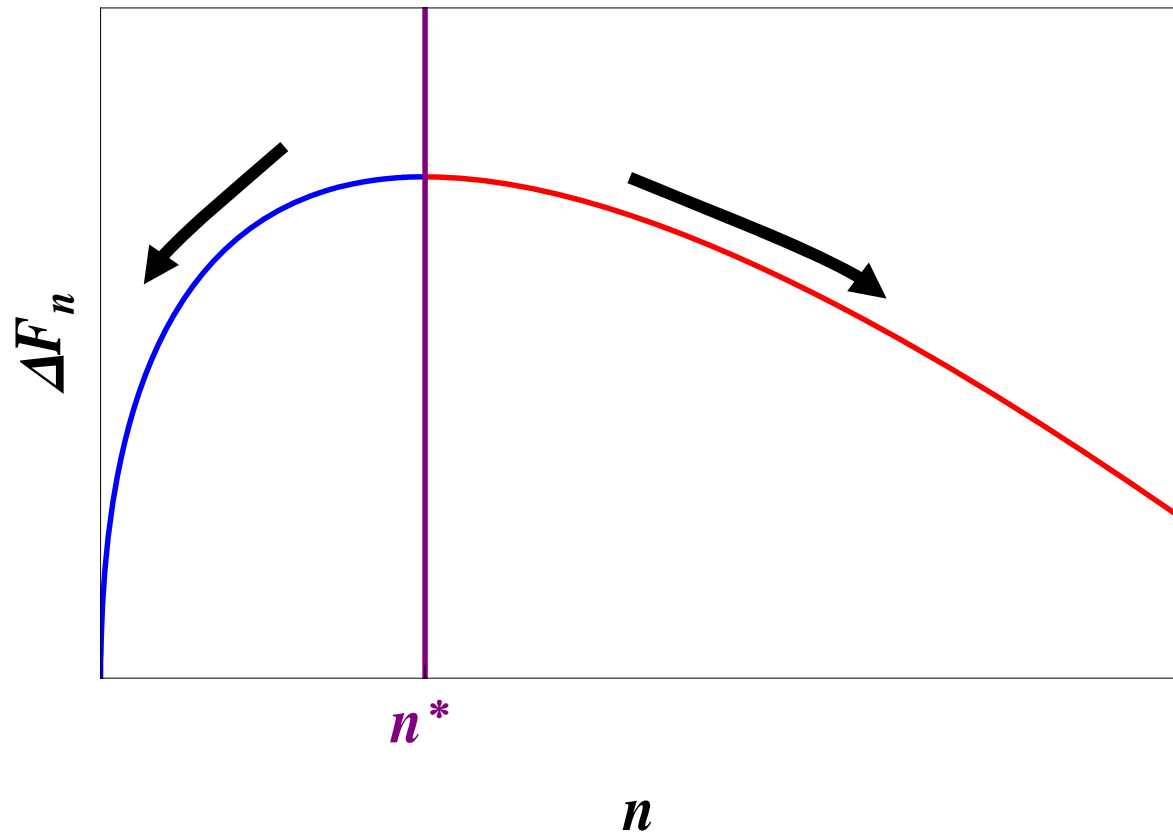
Quelle est la cinétique?



Simulation Monte Carlo Cinétique



Amas sous et sur-critiques

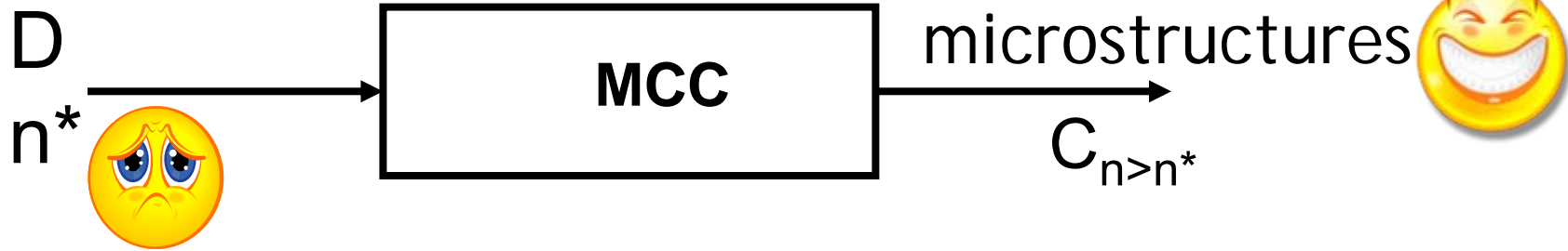


Quantifier le flux de formation des amas surcritiques J

De simulations microscopiques ...

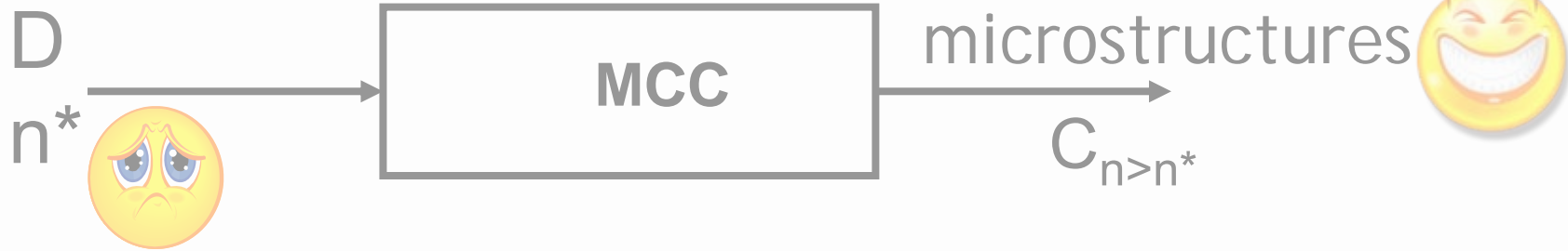


De simulations microscopiques ...

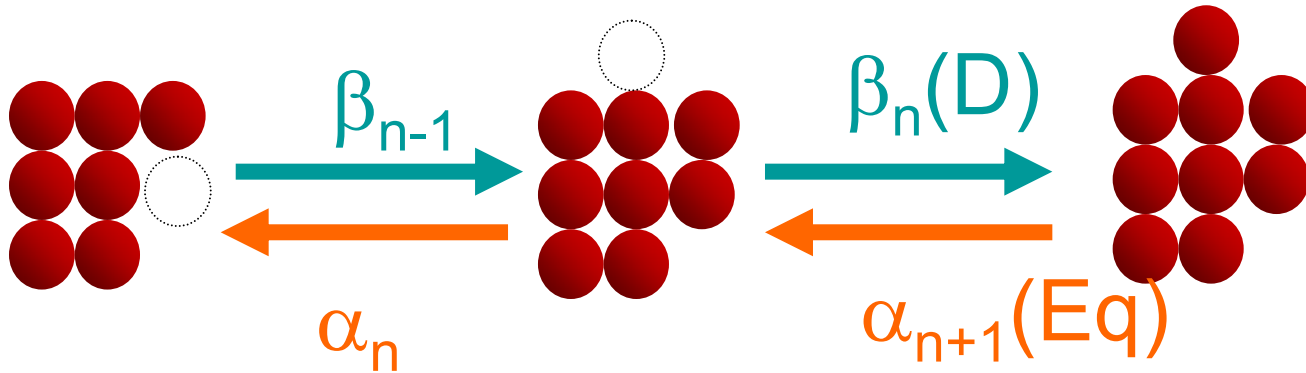


... à un « modèle » DA (mesoscopique)

De simulations microscopiques ...

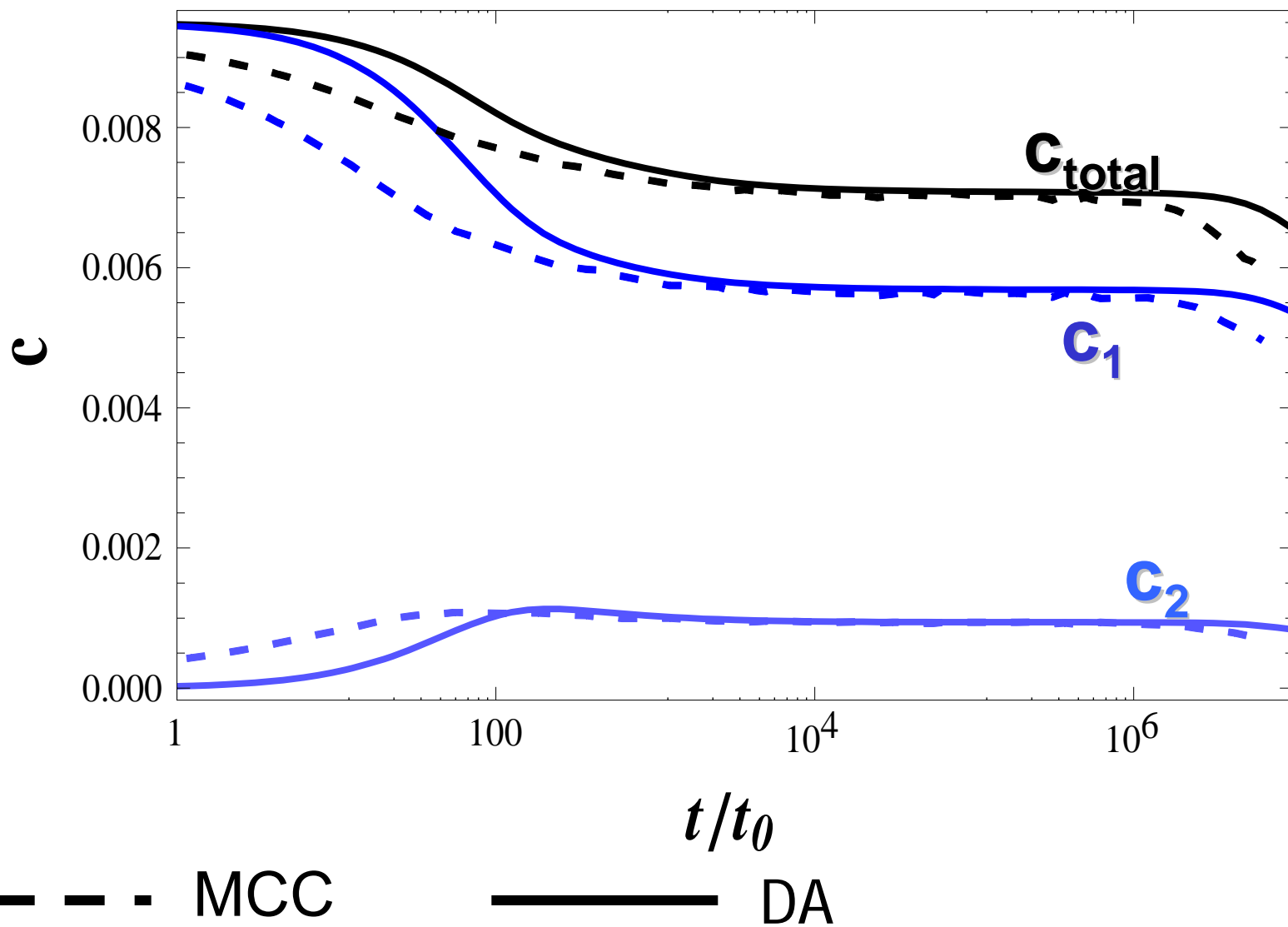


... à un « modèle » DA (mesoscopique)

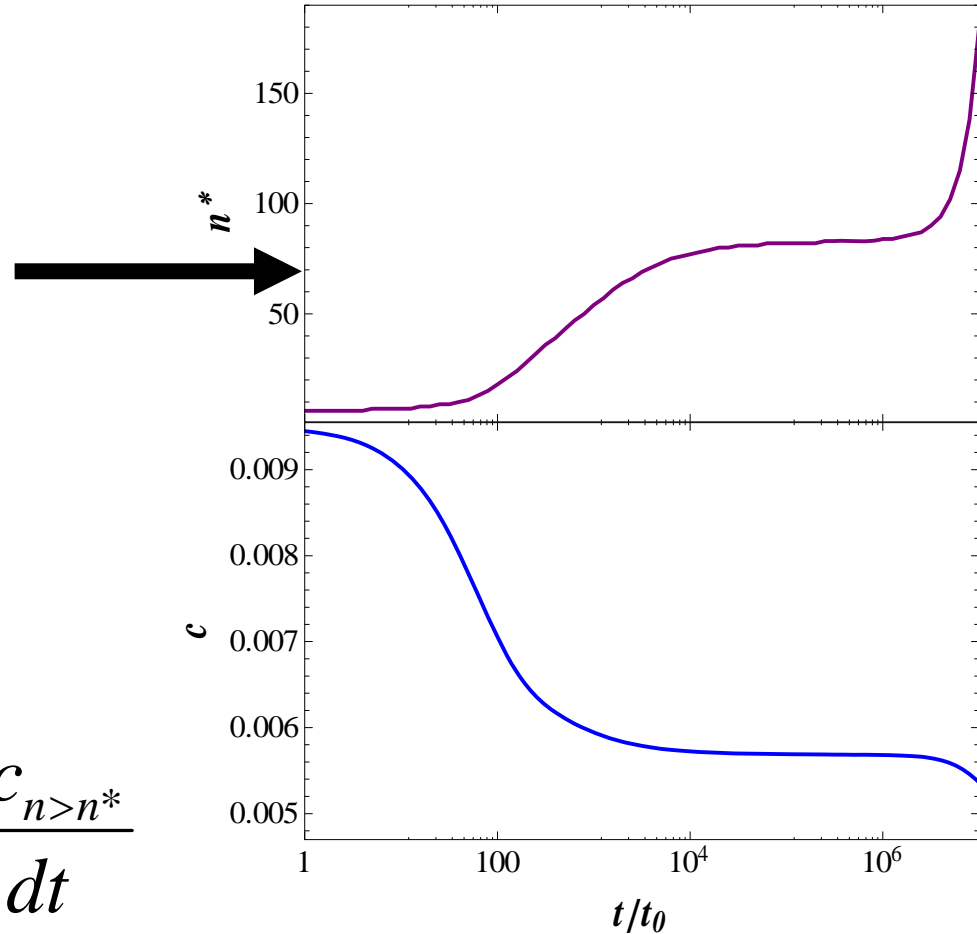
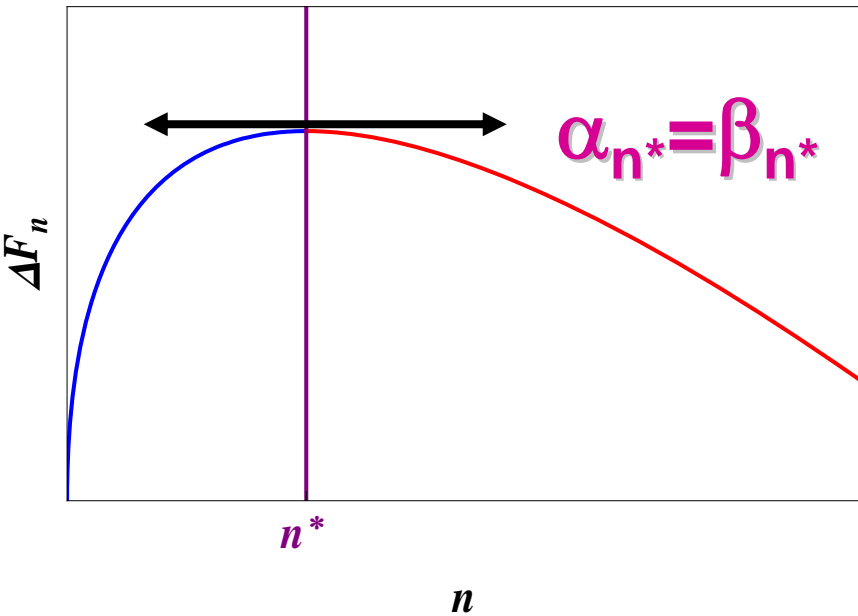


$$\left\{ \begin{array}{l} \frac{dc_n}{dt} = \beta_{n-1}c_{n-1} - (\alpha_n + \beta_n)c_n + \alpha_{n+1}c_{n+1}, \quad \forall n > 1 \\ \frac{dc_1}{dt} = \sum_{i=3}^{\infty} \alpha_i c_i - \sum_{i=2}^{\infty} \beta_i c_i - 2\beta_1 c_1 + 2\alpha_2 c_2 \end{array} \right.$$

Cohérence MCC-DA



DA: estimation de la taille critique n^*

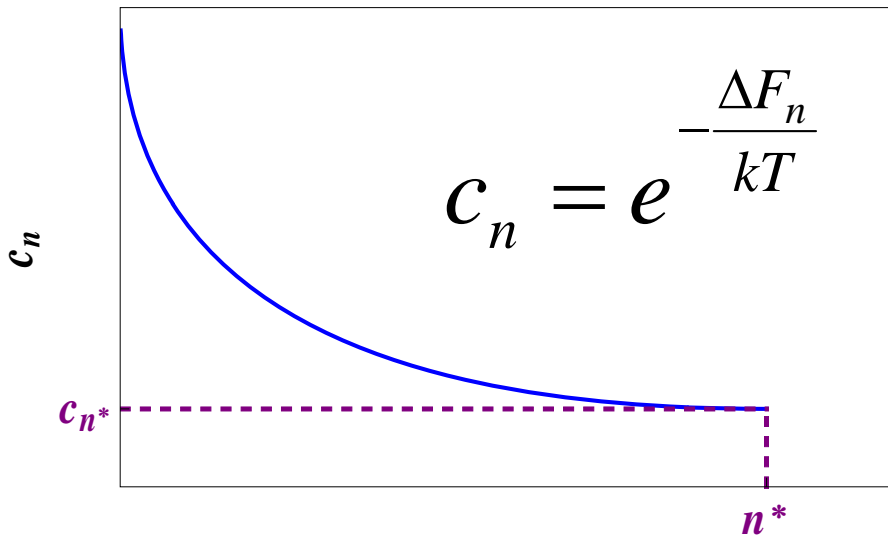
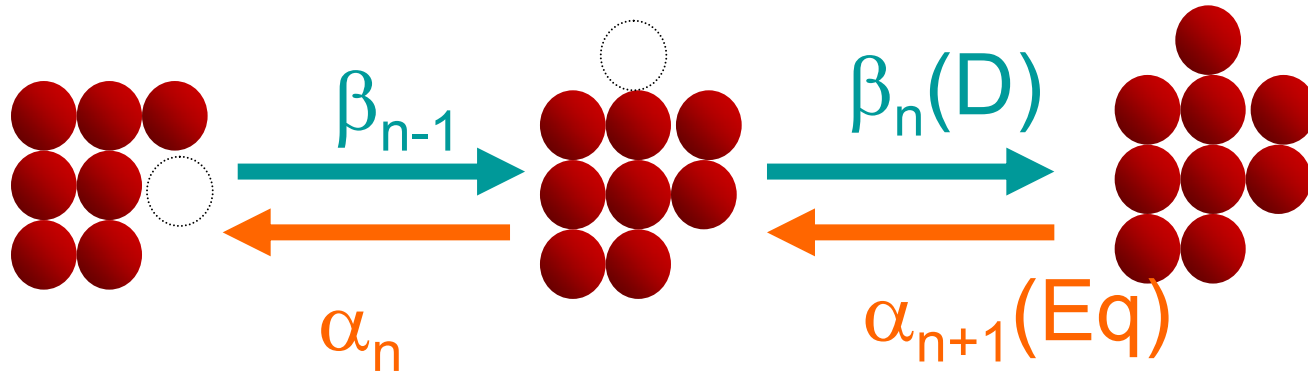


En dénombrant les monomères,
on peut mesurer en DA

$$J = \frac{dc_{n>n^*}}{dt}$$

Quid d'une estimation de J a priori?

Théorie classique de la Germination

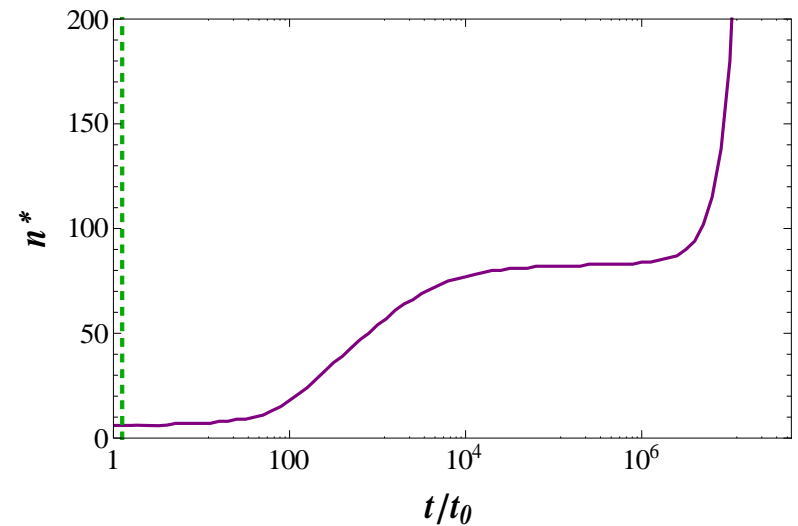
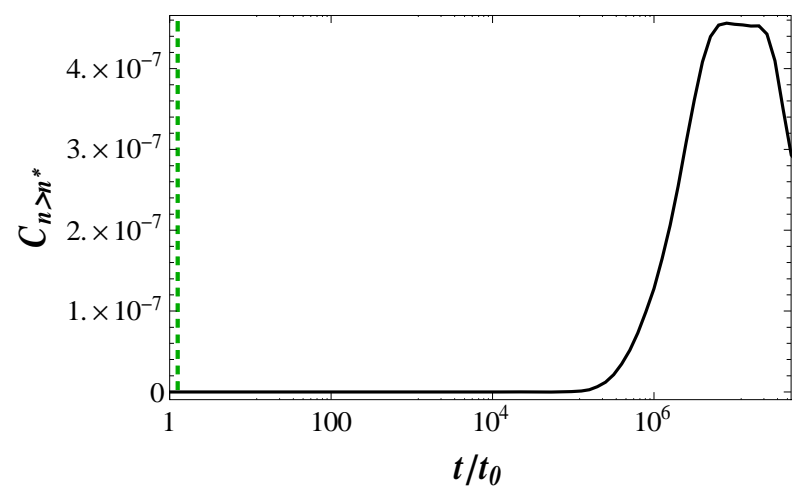
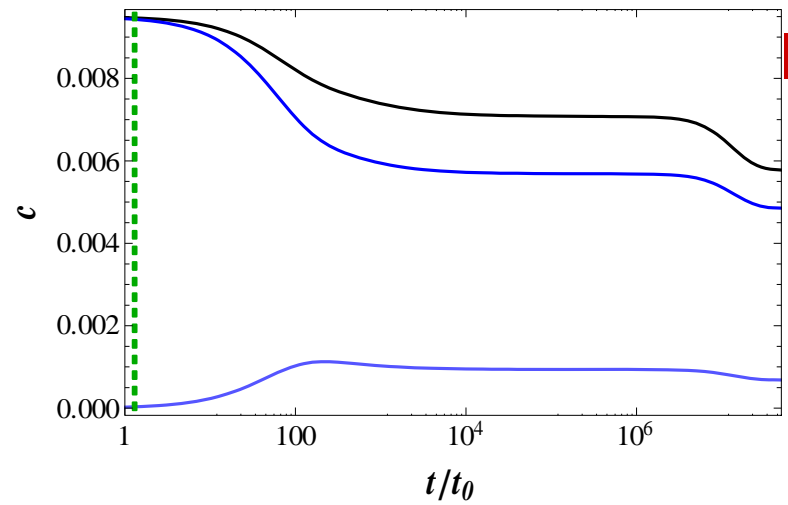
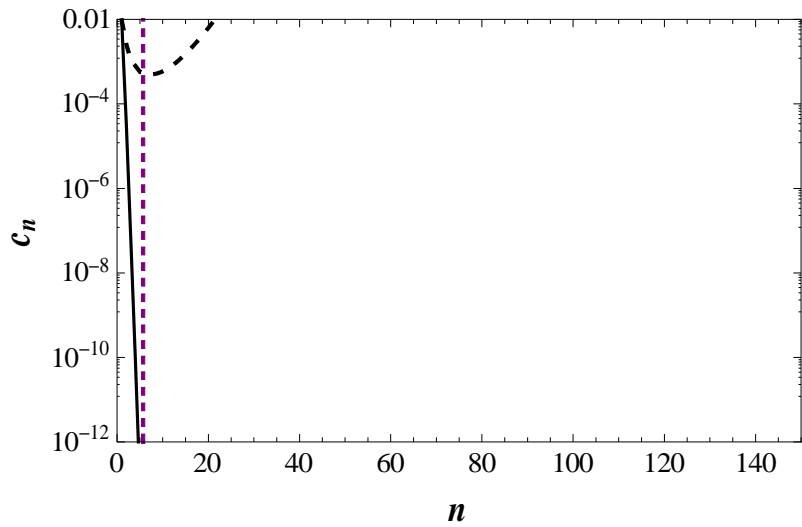


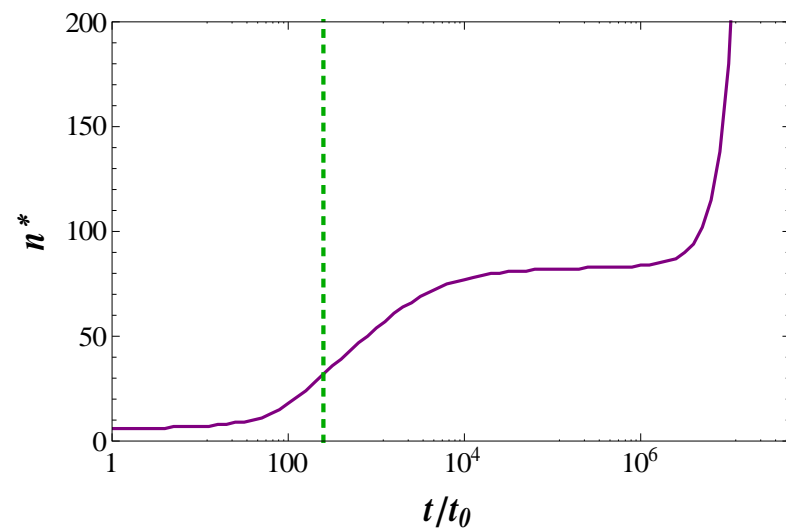
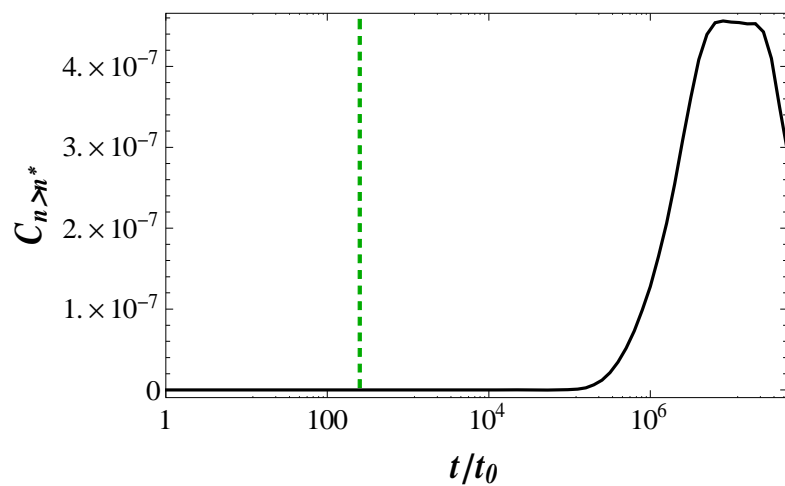
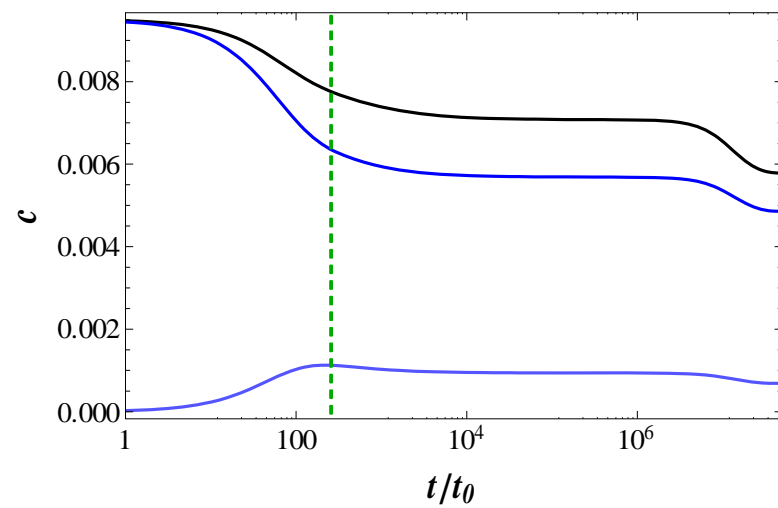
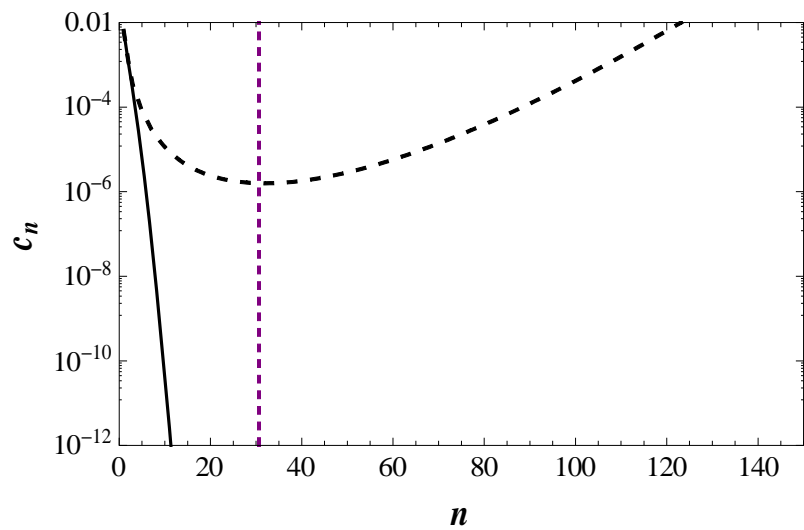
$$J_{\text{TCG}} = c_{n^*} \beta_{n^*} Z$$

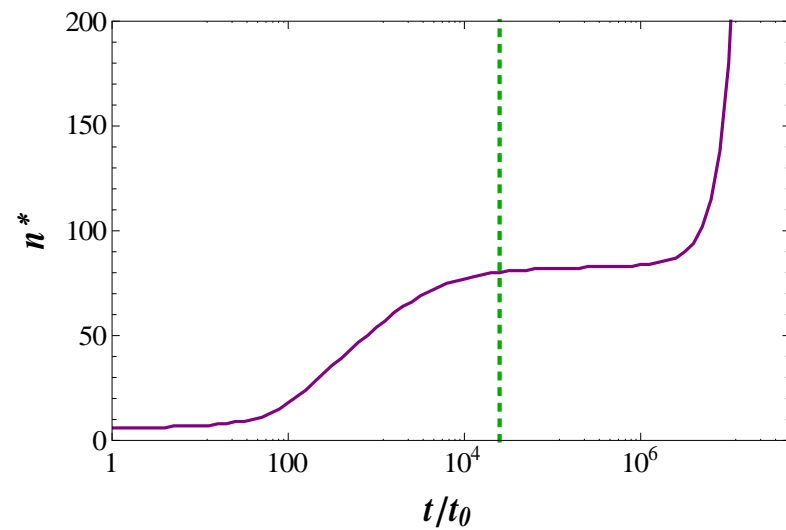
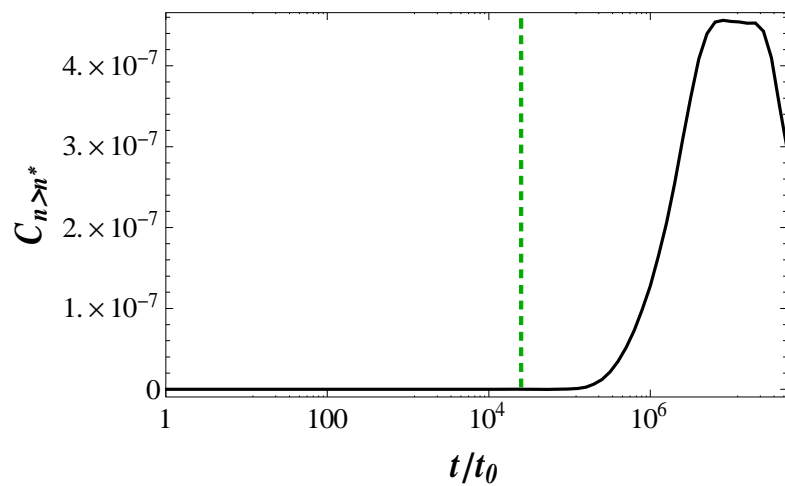
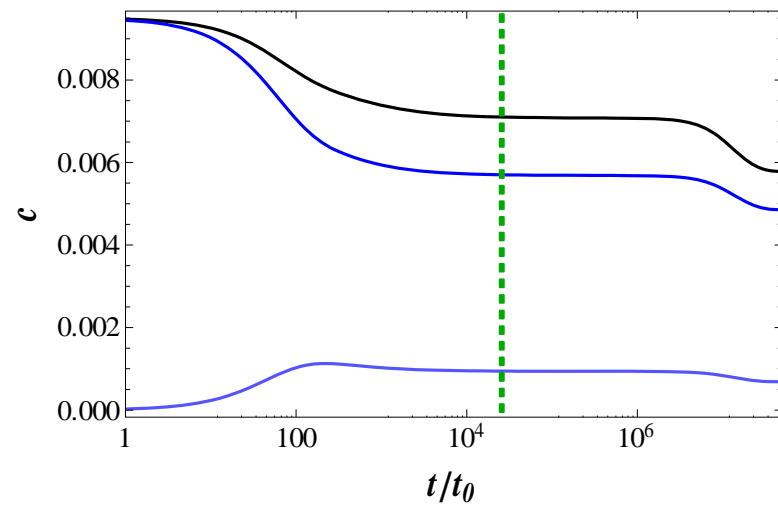
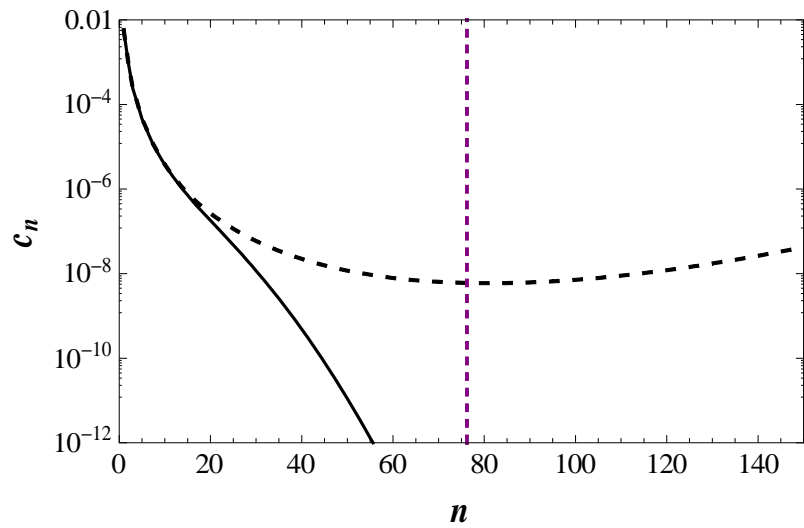
$$J_{\text{TCG}} = f(c_1, n^*)$$

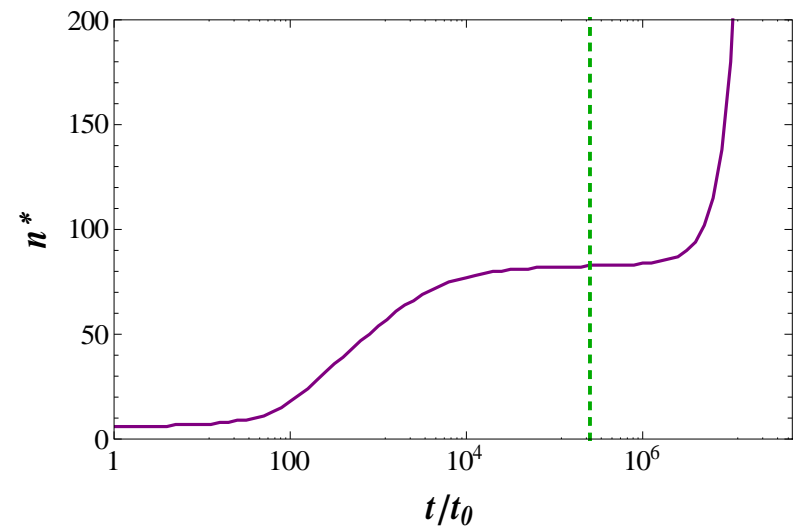
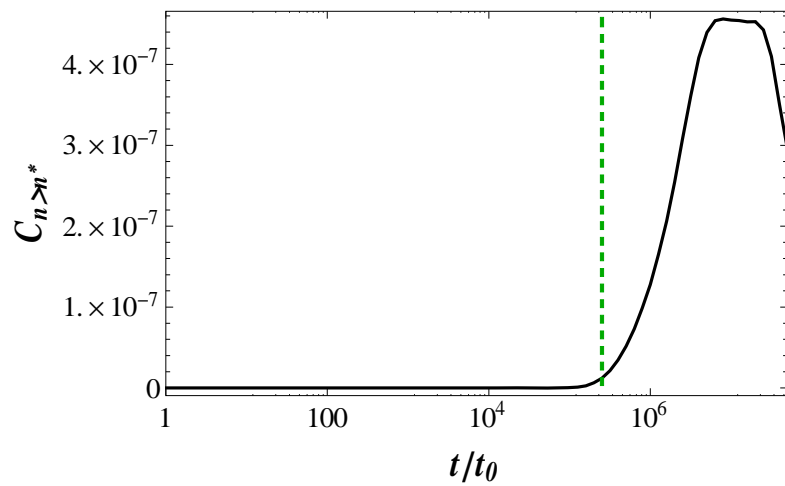
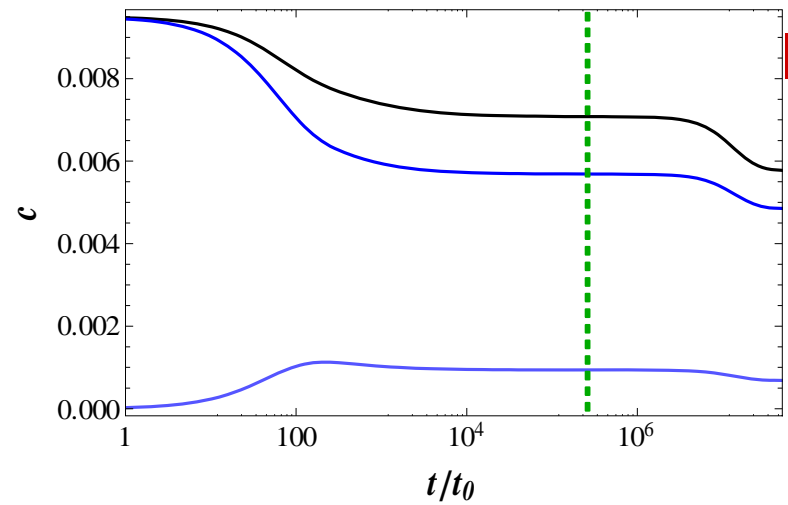
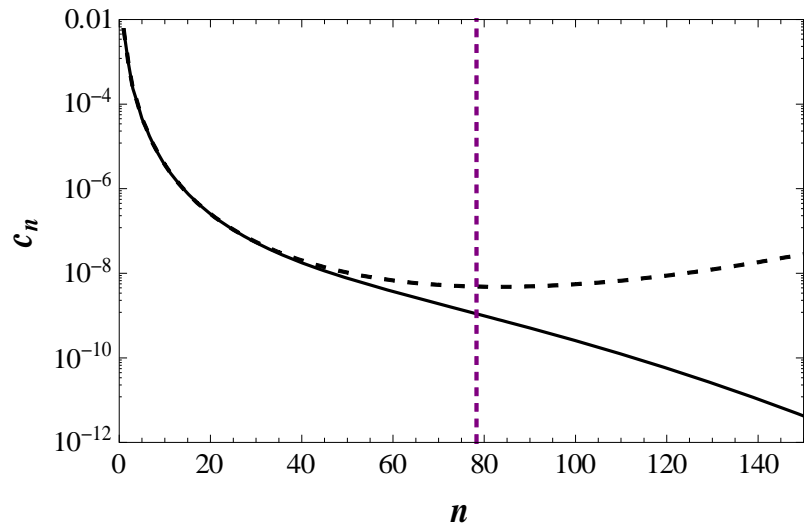
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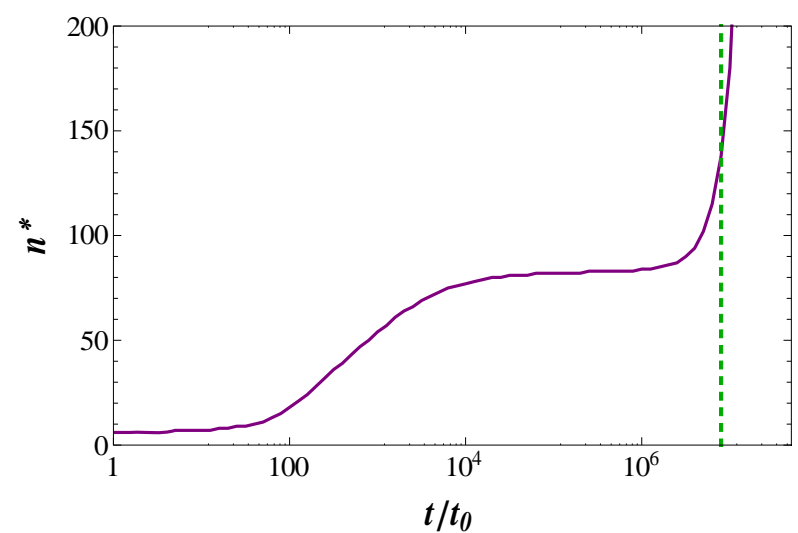
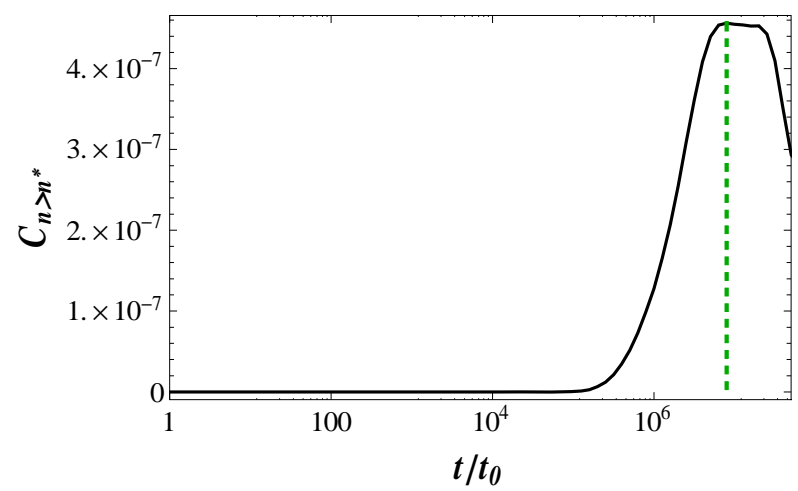
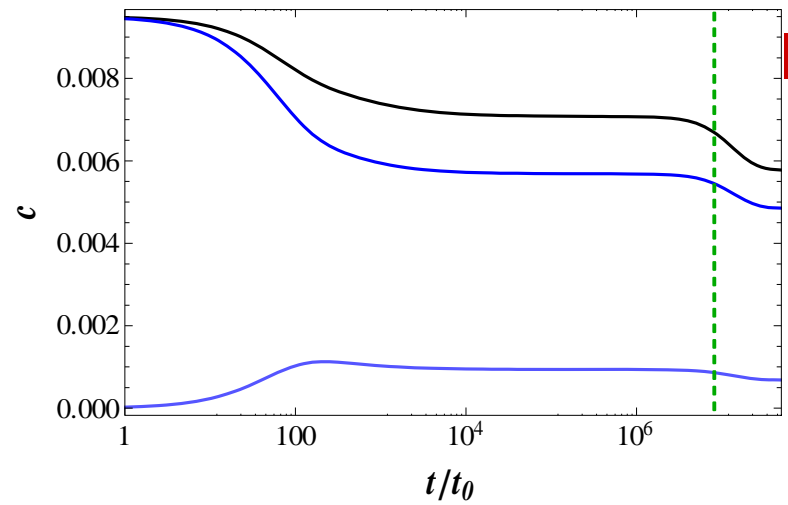
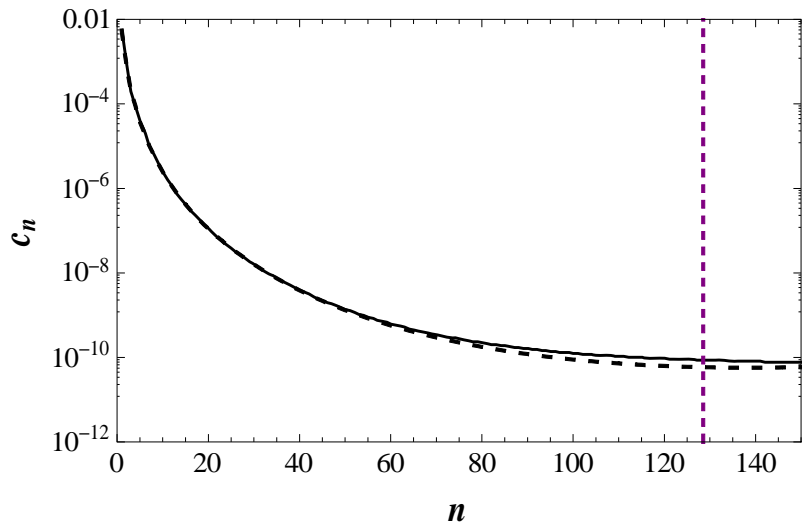
Expression de $J(c_1)$ analytique



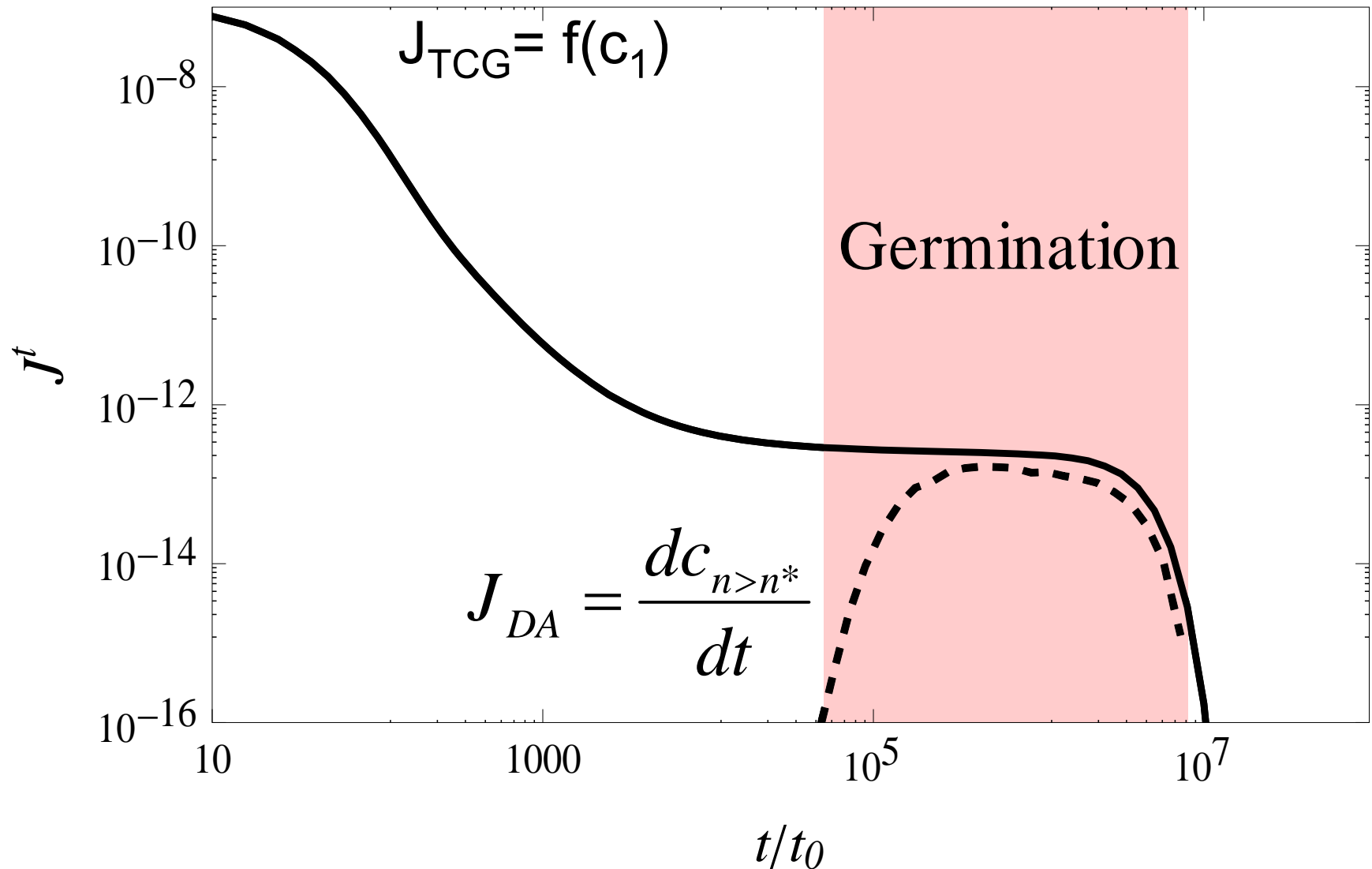




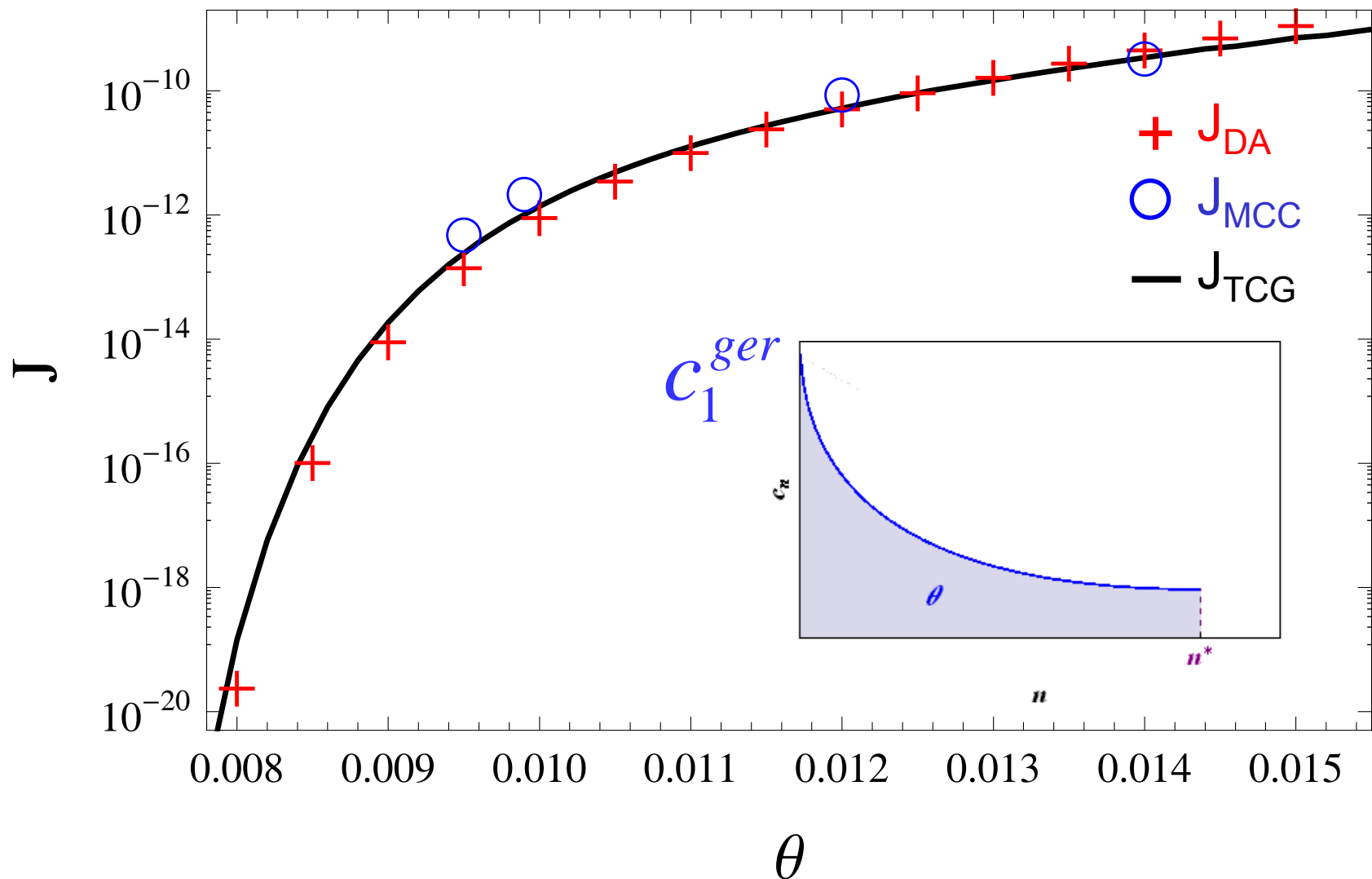




De la DA à la CNT



Estimation de J sans réaliser de cinétique!



Perspectives

De la germination ... à la croissance

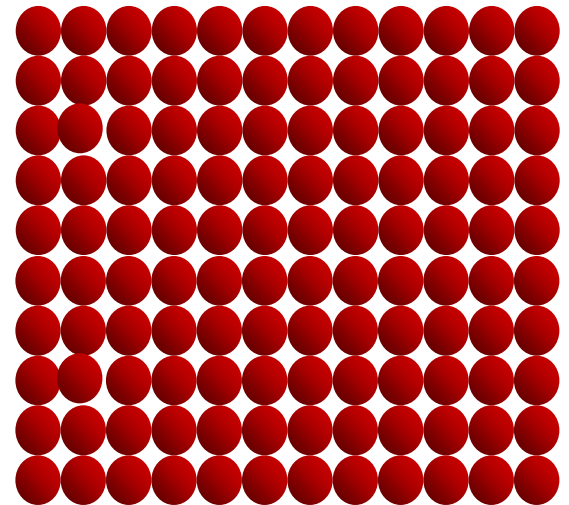
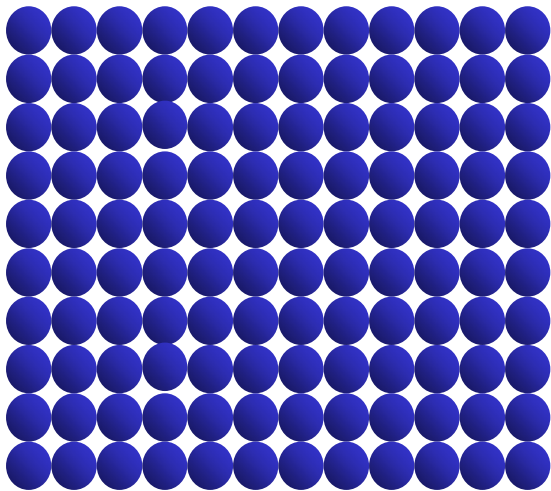
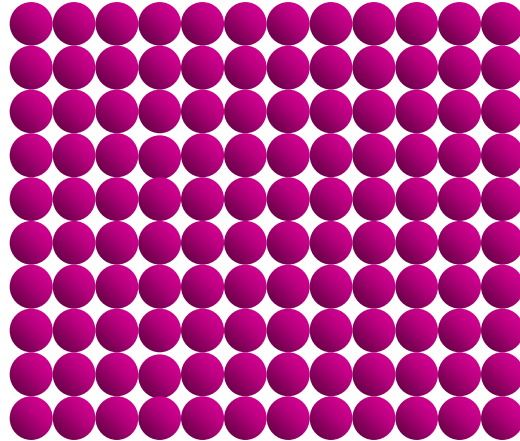
Rôle des inhomogénéités de la surface:

- Défauts cristallins
- Présence d'impuretés prédéposés

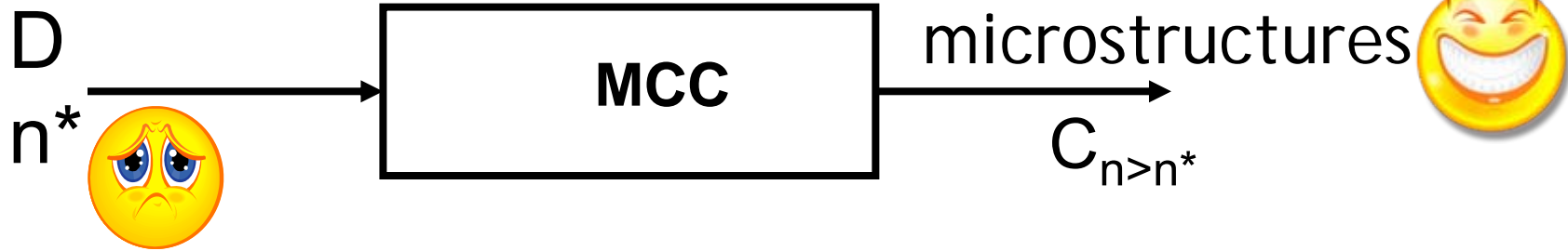
Premiers résultats sur le covieillissement d'un alliage: modification des cinétiques de germination en présence d'impuretés ségrégeantes

LEMHE : vers le développement d'une nouvelle expérience?

Une solution solide hors-équilibre



De simulations microscopiques ...



... à un « modèle » DA (mesoscopique)

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