$*\dagger\dagger$

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$\mathcal{C}^{\alpha}$

$|\quad|\quad|$

$$\frac{D\theta}{Dt} = \frac{\partial\theta}{\partial t} + u \cdot \nabla\theta = 0$$

$$u = (u_1, u_2) = (-\frac{\partial\psi}{\partial y}, \frac{\partial\psi}{\partial x})$$

$$(-\triangle)^{\frac{1}{2}}\psi = \theta\,,$$

$(x,y)\mathbb{R}/_{\mathbb{Z}} \times \mathbb{R} - \triangle^{-\frac{1}{2}}\infty\eta$

$$\frac{\chi(u,v)}{(u^2+v^2)^{\frac{1}{2}}} + \eta(u,v)$$

$\chi(x,y)\epsilon C_0^{\infty},\ \chi(x,y) = 1 \quad |x-y| \leq r \quad supp\chi\{|x-y| \leq R\}$
$0 < r < R < \frac{1}{2}\eta\epsilon C_0^{\infty}\eta(0,0) = 0$

$\theta\phi\,\epsilon\, C_0^{\infty}(\mathbb{R}/_{\mathbb{Z}} \times \mathbb{R} \times [0,\varepsilon])$

$$\int_{\mathbb{R}^+\times\mathbb{R}/_{\mathbb{Z}}\times\mathbb{R}} \theta(x,y,t)\,\partial_t\phi\,(x,y,t)dydxdt +$$
$$+ \quad \int_{\mathbb{R}^+\times\mathbb{R}/_{\mathbb{Z}}\times\mathbb{R}} \theta\,(x,y,t)u(x,y,t)\cdot\nabla\phi\,(x,y,t)dydxdt = 0$$

u

$\sim \frac{1}{\delta}2\delta\theta$

$2\delta\theta\theta$

$$\theta = 1 y \geq \varphi(x,t) + \delta$$

$$\theta|\varphi(x,t) - y| \leq \delta$$

$$\theta = 0 y \leq \varphi(x,t) - \delta$$

$\varphi 0 < \delta < \frac{1}{2}$

$\theta\ \varphi$

$$\begin{aligned}\frac{\partial\varphi}{\partial t}(x,t) &= \int_{\mathbb{R}/_{\mathbb{Z}}} \frac{\frac{\partial\varphi}{\partial x}(x,t) - \frac{\partial\varphi}{\partial u}(u,t)}{[(x-u)^2 + (\varphi(x,t)-\varphi(u,t))^2]^{\frac{1}{2}}} \\ &\quad \chi(x-u, \varphi(x,t)-\varphi(u,t))du\ + \\ &+ \int_{\mathbb{R}/_{\mathbb{Z}}} \Big[\frac{\partial\varphi}{\partial x}(x,t) - \frac{\partial\varphi}{\partial u}(u,t)\Big] \\ &\quad \eta(x-u, \varphi(x,t)-\varphi(u,t))du + Error\end{aligned}$$

$|Error| \leq C\,\delta|log\delta|C\|\theta\|_{L^\infty}\|\nabla\varphi\|_{L^\infty}$
$\varphi\delta\varphi\delta|log\delta|$
$\theta\,X = O(Y)|X| \leq C|Y|C\|\theta\|_{L^\infty}\|\nabla\varphi\|_{L^\infty}\|\phi\|_{C^1}\phi$
$\theta\theta = 0$

$$\int_{I\times\mathbb{R}} \theta(x,y,t)\,\partial_t\phi\,(x,y,t)dydxdt +$$
$$+ \int_{I\times\mathbb{R}} \theta\,(x,y,t)u(x,y,t)\cdot\nabla\phi\,(x,y,t)dydxdt = 0$$

$$\int_{II\times\mathbb{R}} \theta(x,y,t)\partial_t\phi(x,y,t)dxdydt = O(\delta)$$

$\theta O(1)O(\delta)$

$$\int_{II\times\mathbb{R}} u\theta\nabla\phi dxdydt = O(\delta log(\delta))$$

t

$$\int_{\mathbb{R}^2} u\cdot(\nvdash_{II}\theta\nabla\phi)dxdy$$

$$\int_{III\times\mathbb{R}} \theta\partial_t\phi dxdydt + \int_{III\times\mathbb{R}} \theta u_f\cdot\nabla\phi dxdydt =: A + B$$

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- ω_{k+1}

$AAAA$

$B(H)$
$B(H)$

α

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*m_t

n	S^*_{MAX}	t_1	r_1	m_1	t_2	r_2	m_2	t_{lb}	t_1/t_2	r_1/r_2	m_1/m_2	t_1/t_{lb}
*												
†												
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†$R_{\mathrm{FREE}} = R \sim 5$

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