A NOVEL MAPPING OF THE NON-LOCAL FOCK TERMS
ONTO THE RELATIVISTIC HARTREE THEORY

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Pulsars and their environments
18 – 20 May 2016, Paris Observatory, Meudon, France

Covariant DFT with localized Fock

Mapping

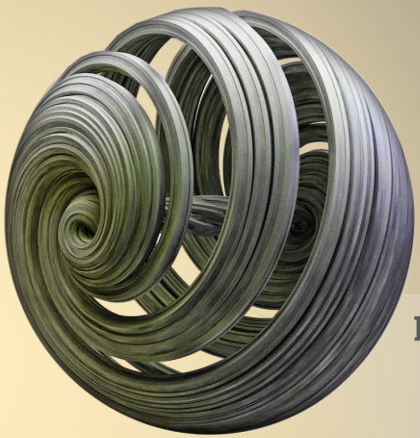
Idea

Hartree

Properties **Local**

Momentum independent
No exchange (Fock) part in the interaction
Phenomenological density dependence

Hartree-Fock



Non-local *Properties*

Momentum dependent
Exchange (Fock) correlations
Intrinsic density dependence

COVARIANT DFT WITH LOCALIZED FOCK

Mapping

Idea

Hartree

Properties **Local**

Momentum independent
No exchange (Fock) part in the interaction
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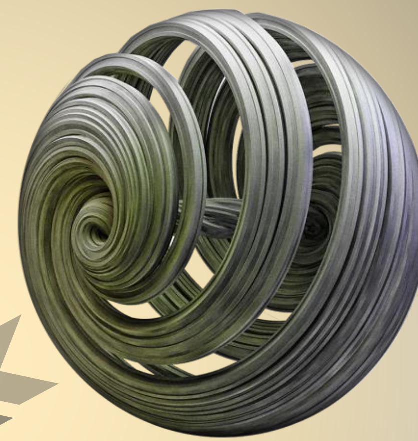
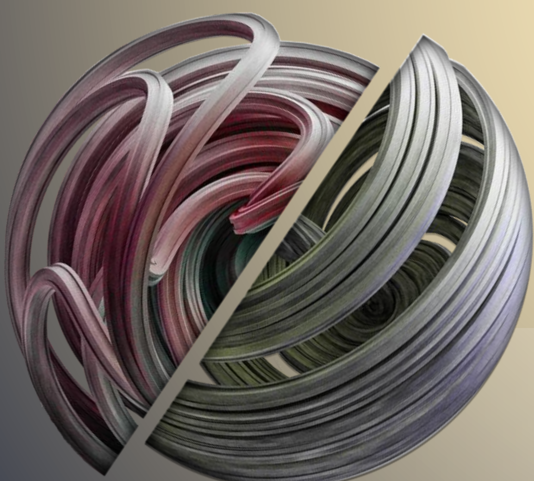


Non-local **Properties**

Momentum dependent
Exchange (Fock) correlations
Intrinsic density dependence

Hartree +



Covariant DFT with localized Fock terms

Properties

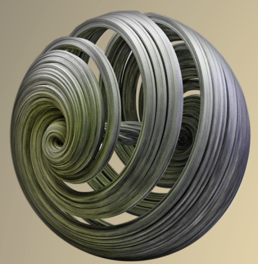
Momentum independent – Locality
Precisely accounted exchange correlations – Fock effects
Hartree-Fock density dependence

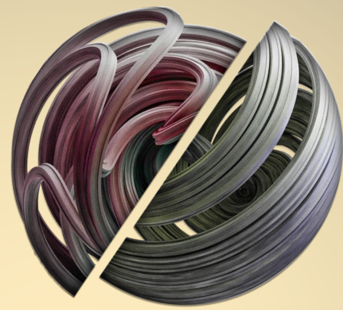
Covariant DFT with localized Fock

Relativistic Hartree-Fock Approach

Starting point

RHF with coupling constants





- \+ no new parameters
- \+ local densities
- \+ high accuracy
- \- symmetric matter

RHF Lagrangian density

$$\mathcal{L}_{\rm HF} = \mathcal{L}_{\rm HF}^{\rm fermi} + \mathcal{L}_{\rm HF}^{\rm bose} + \mathcal{L}_{\rm HF}^{\rm int}$$

$$\begin{aligned}
\mathcal{L}_{\rm HF}^{\rm fermi} &= +\bar{\psi}\left[i\gamma^\mu\partial_\mu - m\right]\psi \\
\mathcal{L}_{\rm HF}^{\rm bose} &= +\frac{1}{2}\partial_\mu\hat{\boldsymbol{\pi}}\cdot\partial^\mu\hat{\boldsymbol{\pi}} - \frac{1}{2}m_\pi^2\hat{\pi}^2 \\
&\quad + \frac{1}{2}\partial_\mu\hat{\sigma}\partial^\mu\hat{\sigma} - \frac{1}{2}m_\sigma^2\hat{\sigma}^2 - \frac{1}{4}\hat{\omega}_{\mu\nu}\hat{\omega}^{\mu\nu} + \frac{1}{2}m_\omega^2\hat{\omega}_\mu\hat{\omega}^\mu \\
&\quad + \frac{1}{2}\partial_\mu\hat{\boldsymbol{\delta}}\cdot\partial^\mu\hat{\boldsymbol{\delta}} - \frac{1}{2}m_\delta^2\hat{\delta}^2 - \frac{1}{4}\hat{\boldsymbol{\rho}}_{\mu\nu}\cdot\hat{\boldsymbol{\rho}}^{\mu\nu} + \frac{1}{2}m_\rho^2\hat{\boldsymbol{\rho}}_\mu\cdot\hat{\boldsymbol{\rho}}^\mu \\
&\quad - \frac{1}{4}\hat{A}_{\mu\nu}\hat{A}^{\mu\nu}, \\
\mathcal{L}_{\rm HF}^{\rm int} &= +\bar{\psi}\Big[g_\sigma\hat{\sigma} + g_\delta\hat{\boldsymbol{\delta}}\cdot\boldsymbol{\tau} - g_\omega\gamma^\mu\hat{\omega}_\mu - g_\rho\gamma^\mu\hat{\boldsymbol{\rho}}_\mu\cdot\boldsymbol{\tau} \\
&\qquad - \frac{f_\pi}{m_\pi}\gamma_5\gamma^\mu\partial_\mu\hat{\boldsymbol{\pi}}\cdot\boldsymbol{\tau} - \frac{f_\rho}{2m}\sigma^{\mu\nu}\partial_\mu\hat{\boldsymbol{\rho}}^\nu\cdot\boldsymbol{\tau} \\
&\qquad - e\gamma^\mu Q\hat{A}_\mu\Big]\psi,
\end{aligned}$$

$\pi_{\rm pv}$, σ, ω, δ, $\rho_{\rm v}$, $\rho_{\rm t}$, $\rho_{\rm vt}$

A. Bouyssy, *et al.*, PRC 36, 380 (1987)

	HF_1	HF_2	HF_3	HF_4
g_σ	8.3437	8.1994	5.3409	7.2302
g_ω	12.4021	12.4930	11.2099	11.8529
g_π	–	13.6433	13.6433	13.6433
f_π	–	1.00265	1.00265	1.00265
g_ρ	–	–	2.62897	2.62897
f_ρ	–	–	17.35123	9.72719
κ	–	–	6.6	3.7

COVARIANT DFT WITH LOCALIZED FOCK

Relativistic Hartree-Fock Approach

Dirac equation

$$\left[(\gamma^\mu k_\mu - \gamma^0\Sigma_o - \boldsymbol{\gamma}\cdot\hat{\boldsymbol{k}}\Sigma_v) - (m+\Sigma_s)\right]\psi = 0$$

1 **SELF-ENERGY**

$$\Sigma(k,k_F) = \Sigma_s(k,k_F) + \gamma^0\Sigma_o(k,k_F) + \boldsymbol{\gamma}\cdot\hat{\boldsymbol{k}}\Sigma_v(k,k_F)$$

Energy density

Functional derivatives with respect to density

2 **ENERGY DENSITY**

$$\mathcal{E} = \langle\psi_0|\mathcal{H}|\psi_0\rangle = \epsilon_{kin} + \epsilon_D + \epsilon_E$$

HARTREE

$$\epsilon^D = \sum_{\sigma,\omega,\rho,\delta} \epsilon_i^D$$

$$\epsilon_\sigma^D = -\frac{1}{2}\frac{g_\sigma^2}{m_\sigma^2}\rho_S^2$$

$$\epsilon_\omega^D = +\frac{1}{2}\frac{g_\omega^2}{m_\omega^2}\rho_B^2$$

$$\epsilon_\delta^D = -\frac{1}{2}\frac{g_\delta^2}{m_\delta^2}\rho_{S_3}^2$$

$$\epsilon_\rho^D = +\frac{1}{2}\frac{g_\rho^2}{m_\rho^2}\rho_{B_3}^2$$

FOCK

$$\epsilon^E = \sum_{\substack{\sigma,\omega,\delta\\ \pi_{pv},\rho_v,\rho_t}} \frac{1}{2}\frac{1}{(2\pi)^4}\sum_{\tau,\tau'} f_{\tau,\tau'}\int_0^{k_{F\tau}} k\,dk \int_0^{k_{F\tau'}} q\,dq \left[A_j(k,q) + \hat{M}(k)\hat{M}(q)B_j(k,q) + \hat{P}(k)\hat{P}(q)C_j(k,q)\right]$$

Motivation

- *Momentum dependent meson propagators*
- *Fierz transformation*
- *Heavy meson mass limit*

Covariant DFT with localized Fock

Localized Fock Approximation

Energy density

TIME-LIKE VECTOR

SCALAR

SPACE-LIKE VECTOR

$$\mathcal{E}^E = \mathcal{E}^E_o + \mathcal{E}^E_s + \mathcal{E}^E_v + \mathcal{E}^E_{\rho vt}$$

$$\mathcal{E}^E_o = \sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{\gamma}{4}\frac{\bar{A}_j}{(2\pi)^4}\int_0^{k_F} kdk \int_0^{k_F} qdq\, \Theta_j(k,q),$$

$$\mathcal{E}^E_s = \sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{\gamma}{4}\frac{\bar{B}_j}{(2\pi)^4}\int_0^{k_F} kdk\hat{M}(k) \int_0^{k_F} qdq\hat{M}(q)\Theta_j(k,q),$$

$$\mathcal{E}^E_v = \sum_{\sigma,\omega,\delta,\rho_v} \frac{\gamma}{4}\frac{\bar{C}_i}{(2\pi)^4}\int_0^{k_F} kdk\hat{P}(k) \int_0^{k_F} qdq\hat{P}(q)\Phi_i(k,q)$$
$$+ \frac{\gamma}{4}\frac{1}{m_\pi^2}\frac{\bar{C}_{\pi_{pv}}}{(2\pi)^4}\int_0^{k_F} kdk\hat{P}(k) \int_0^{k_F} qdq\hat{P}(q)\Lambda_\pi(k,q)$$
$$+ \frac{\gamma}{4}\frac{1}{m_\rho^2}\frac{\bar{C}_{\rho_t}}{(2\pi)^4}\int_0^{k_F} kdk\hat{P}(k) \int_0^{k_F} qdq\hat{P}(q)\Psi_\rho(k,q),$$

$$\mathcal{E}^E_{\rho_{vt}} = \frac{\gamma}{4}\frac{1}{m}\frac{\bar{D}_{\rho_{vt}}}{(2\pi)^4}\int_0^{k_F} kdk\hat{P}(k) \int_0^{k_F} qdq\hat{M}(q)\,\Omega_\rho(k,q).$$

$$I_F = \int_0^{k_F} kdk \int_0^{k_F} qdq\, F(k,q)$$

Analytic solution

LFA
for Energy density

$$J_F\rho_B^2 \approx I_F\rho_S^2$$
$$K_F\rho_B^2 \approx I_F\rho_V^2$$
$$L_F\rho_B^2 \approx I_F\rho_V\rho_S$$

Densities

$$\rho_B = \frac{\gamma}{2\pi^2}\int_0^{k_F} k^2 dk = \frac{\gamma}{2}\frac{k_F{}^3}{3\pi^2}$$

$$\rho_S = \frac{\gamma}{2}\frac{1}{\pi^2}\int_0^{k_F} k^2 dk\hat{M}(k)$$

$$\rho_V = \frac{\gamma}{2}\frac{1}{\pi^2}\int_0^{k_F} k^2 dk\hat{P}(k)$$

$$\hat{M} = \frac{m^*}{E^*}, \quad \hat{P} = \frac{p^*}{E^*}$$

Angular exchange functions

$$F = (\Theta_j, \Phi_i, \Lambda_\pi, \Psi_\rho, \Omega_\rho)$$

Covariant DFT with localized Fock

Localized Fock Approximation

Self-energy

! momentum dependent

TIME-LIKE VECTOR

SCALAR

SPACE-LIKE VECTOR

$$\Sigma_o^E = \sum_{\substack{\sigma,\omega,\delta,\rho_v \\ \pi_{pv},\rho_t}} \frac{\bar{A}_j}{(4\pi)^2} \frac{1}{k} \int_0^{k_F} q dq\, \Theta_j(k,q),$$

$$\Sigma_s^E = \sum_{\substack{\sigma,\omega,\delta,\rho_v \\ \pi_{pv},\rho_t}} \frac{\bar{B}_j}{(4\pi)^2} \frac{1}{k} \int_0^{k_F} q dq \hat{M}(q) \Theta_j(k,q)$$

$$+ \frac{1}{2}\frac{1}{m} \frac{\bar{D}_{\rho vt}}{(4\pi)^2} \frac{1}{k} \int_0^{k_F} q dq \hat{P}(q)\, \Omega_\rho(k,q),$$

$$\Sigma_v^E = \sum_{\sigma,\omega,\delta,\rho_v} \frac{\bar{C}_i}{(4\pi)^2} \frac{1}{k} \int_0^{k_F} q dq \hat{P}(q) \Phi_i(k,q)$$

$$+ \frac{1}{m_\pi^2} \frac{\bar{C}_{\pi_{pv}}}{(4\pi)^2} \frac{1}{k} \int_0^{k_F} q dq \hat{P}(q) \Lambda_\pi(k,q)$$

$$+ \frac{1}{m_\rho^2} \frac{\bar{C}_{\rho_t}}{(4\pi)^2} \frac{1}{k} \int_0^{k_F} q dq \hat{P}(q) \Psi_\rho(k,q)$$

$$+ \frac{1}{2}\frac{1}{m} \frac{\bar{D}_{\rho vt}}{(4\pi)^2} \frac{1}{k} \int_0^{k_F} q dq \hat{M}(q)\, \Omega_\rho(k,q).$$

1

$$I_F^\Sigma = \left\langle I_F^\Sigma(k) \right\rangle_k$$

$$J_F^\Sigma = \left\langle J_F^\Sigma(k) \right\rangle_k$$

$$K_F^\Sigma = \left\langle K_F^\Sigma(k) \right\rangle_k$$

k-average over Fermi sphere

LFA for Self-energy 2

$$I_F^\Sigma \rho_B^2 = \frac{\gamma}{2\pi^2} I_F \rho_B$$

$$J_F^\Sigma \rho_B^2 \approx \frac{\gamma}{2\pi^2} I_F \rho_S$$

$$K_F^\Sigma \rho_B^2 \approx \frac{\gamma}{2\pi^2} I_F \rho_V$$

Analytic solution

$$I_F = \int_0^{k_F} k dk \int_0^{k_F} q dq\, F(k,q)$$

$$\hat{M} = \frac{m^*}{E^*}, \quad \hat{P} = \frac{p^*}{E^*}$$

Angular exchange functions

$$F = (\Theta_j, \Phi_i, \Lambda_\pi, \Psi_\rho, \Omega_\rho)$$

Covariant DFT with localized Fock

Localized Fock Approximation

New coupling functions

TIME-LIKE VECTOR

SCALAR

SPACE-LIKE VECTOR

Energy density

$$\mathcal{E}_o = \mathcal{E}_o^D + \mathcal{E}_o^E = +\frac{1}{2}\left[\frac{g_\omega^2}{m_\omega^2} + \sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{A_j}{2\gamma}\frac{g_j^2}{m_j^2} X_{\Theta_j}(k_F, m_j)\right]\rho_B^2 = +\frac{1}{2}\frac{G_\omega^2}{m_\omega^2}\rho_B^2,$$

$$\mathcal{E}_S = \mathcal{E}_S^D + \mathcal{E}_S^E = -\frac{1}{2}\left[\frac{g_\sigma^2}{m_\sigma^2} - \sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{B_j}{2\gamma}\frac{g_j^2}{m_j^2} X_{\Theta_j}(k_F, m_j)\right]\rho_S^2 = -\frac{1}{2}\frac{G_\sigma^2}{m_\sigma^2}\rho_S^2,$$

$$\mathcal{E}_V = \mathcal{E}_V^E = +\frac{1}{2}\left[\sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{C_j}{2\gamma}\frac{g_j^2}{m_j^2} Y_j(k_F, m_j)\right]\rho_V^2 = +\frac{1}{2}\frac{G_V^2}{m_\pi^2}\rho_V^2,$$

$$\mathcal{E}_{\rho_{vt}}^E = +\frac{1}{2}\left[\frac{D_{\rho_{vt}}}{2\gamma}\frac{g_\rho^2}{m_\rho^2} Z_{\Omega_\rho}(k_F, m_\rho, m)\right]\rho_V\rho_S = +\frac{1}{2}\frac{G_{\rho_{vt}}^2}{m_\rho^2}\rho_V\rho_S.$$

Self-energy

$$\Sigma_o = \Sigma_o^D + \Sigma_o^E = +\left[\frac{g_\omega^2}{m_\omega^2} + \sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{A_j}{2\gamma}\frac{g_j^2}{m_j^2} X_{\Theta_j}(k_F, m_j)\right]\rho_B = +\frac{G_\omega^2}{m_\omega^2}\rho_B,$$

$$\Sigma_S = \Sigma_S^D + \Sigma_S^E = -\left[\frac{g_\sigma^2}{m_\sigma^2} - \sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{B_j}{2\gamma}\frac{g_j^2}{m_j^2} X_{\Theta_j}(k_F, m_j)\right]\rho_S = -\frac{G_\sigma^2}{m_\sigma^2}\rho_S,$$

$$\Sigma_V = \Sigma_V^E = +\left[\sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{C_j}{2\gamma}\frac{g_j^2}{m_j^2} Y_j(k_F, m_j)\right]\rho_V = +\frac{G_V^2}{m_\pi^2}\rho_V,$$

$$\Sigma_{\rho_{vt}} = +\frac{1}{2}\left[\frac{D_{\rho_{vt}}}{2\gamma}\frac{g_\rho^2}{m_\rho^2} Z_{\Omega_\rho}(k_F, m_\rho, m)\right](\rho_V + \rho_S) = +\frac{1}{2}\frac{G_{\rho_{vt}}^2}{m_\rho^2}(\rho_V + \rho_S).$$

HARTREE — FOCK

$$\frac{G_\sigma^2}{m_\sigma^2} = +\frac{g_\sigma^2}{m_\sigma^2} - \frac{g_\sigma^2}{m_\sigma^2}\frac{1}{2\gamma}X_{\Theta_\sigma} + \frac{g_\omega^2}{m_\omega^2}\frac{2}{\gamma}X_{\Theta_\omega} + \frac{g_\rho^2}{m_\rho^2}\frac{2(\gamma-1)}{\gamma}X_{\Theta_\rho} - \frac{g_\delta^2}{m_\delta^2}\frac{(\gamma-1)}{2\gamma}X_{\Theta_\delta} + \frac{g_\pi^2}{m_\pi^2}\frac{(\gamma-1)}{2\gamma}\frac{m_\pi^2}{4m^2}X_{\Theta_\pi} + \frac{g_\rho^2}{m_\rho^2}\frac{(\gamma-1)}{2\gamma}\frac{3\kappa^2 m_\rho^2}{4m^2}X_{\Theta_\rho}$$

New coupling function

example

$$X_{\Theta_j}(k_F, m_j) = \left[\frac{9}{4}\frac{m_j^2}{k_F^6}I_{\Theta_j}\right],$$

$$Y_{\Phi_i}(k_F, m_i) = \left[\frac{9}{4}\frac{m_i^2}{k_F^6}I_{\Phi_i}\right],$$

$$Y_{\Lambda_\pi}(k_F, m_\pi) = \left[\frac{9}{4}\frac{1}{k_F^6}I_{\Lambda_\pi}\right],$$

$$Y_{\Psi_\rho}(k_F, m_\rho) = \left[\frac{9}{4}\frac{1}{k_F^6}I_{\Psi_\rho}\right],$$

$$Z_{\Omega_\rho}(k_F, m_\rho, m) = \left[\frac{9}{4}\frac{1}{m}\frac{m_\rho^2}{k_F^6}I_{\Omega_\rho}\right].$$

Exchange functions

Covariant DFT with localized Fock

Localized Fock Approximation

New coupling functions

Energy density

$$\mathcal{E}_o = \mathcal{E}_o^D + \mathcal{E}_o^E = +\frac{1}{2}\left[\frac{g_\omega^2}{m_\omega^2} + \sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{A_j}{2\gamma}\frac{g_j^2}{m_j^2} X_{\Theta_j}(k_F, m_j)\right]\rho_B^2 = +\frac{1}{2}\frac{G_\omega^2}{m_\omega^2}\rho_B^2,$$

$$\mathcal{E}_s = \mathcal{E}_s^D + \mathcal{E}_s^E = -\frac{1}{2}\left[\frac{g_\sigma^2}{m_\sigma^2} - \sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{B_j}{2\gamma}\frac{g_j^2}{m_j^2} X_{\Theta_j}(k_F, m_j)\right]\rho_S^2 = -\frac{1}{2}\frac{G_\sigma^2}{m_\sigma^2}\rho_S^2,$$

$$\mathcal{E}_v = \mathcal{E}_v^E = +\frac{1}{2}\left[\sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{C_j}{2\gamma}\frac{g_j^2}{m_j^2} Y_j(k_F, m_j)\right]\rho_V^2 = +\frac{1}{2}\frac{G_v^2}{m_\pi^2}\rho_V^2,$$

$$\mathcal{E}_{\rho_{vt}}^E = +\frac{1}{2}\left[\frac{D_{\rho_{vt}}}{2\gamma}\frac{g_\rho^2}{m_\rho^2} Z_{\Omega_\rho}(k_F, m_\rho, m)\right]\rho_V\rho_S = +\frac{1}{2}\frac{G_{\rho_{vt}}^2}{m_\rho^2}\rho_V\rho_S.$$

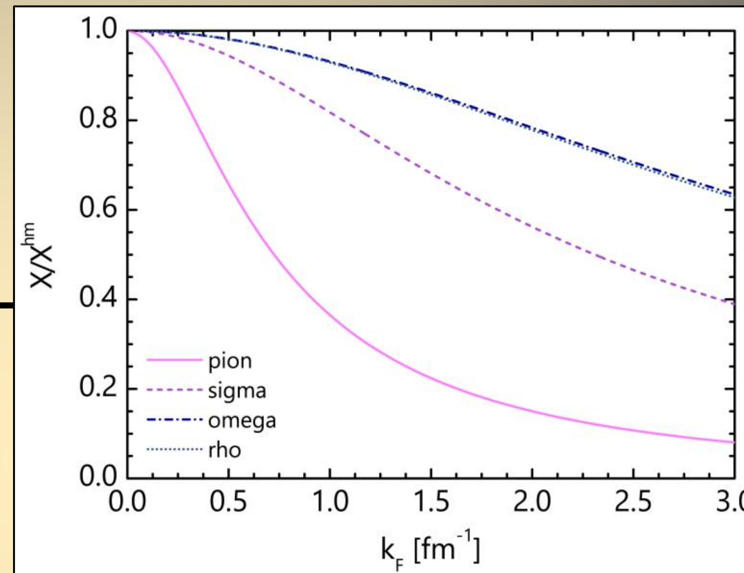
Self-energy

$$\Sigma_o = \Sigma_o^D + \Sigma_o^E = +\left[\frac{g_\omega^2}{m_\omega^2} + \sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{A_j}{2\gamma}\frac{g_j^2}{m_j^2} X_{\Theta_j}(k_F, m_j)\right]\rho_B = +\frac{G_\omega^2}{m_\omega^2}\rho_B,$$

$$\Sigma_s = \Sigma_s^D + \Sigma_s^E = -\left[\frac{g_\sigma^2}{m_\sigma^2} - \sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{B_j}{2\gamma}\frac{g_j^2}{m_j^2} X_{\Theta_j}(k_F, m_j)\right]\rho_S = -\frac{G_\sigma^2}{m_\sigma^2}\rho_S,$$

$$\Sigma_v = \Sigma_v^E = +\left[\sum_{\substack{\sigma,\omega,\delta,\rho_v\\ \pi_{pv},\rho_t}} \frac{C_j}{2\gamma}\frac{g_j^2}{m_j^2} Y_j(k_F, m_j)\right]\rho_V = +\frac{G_v^2}{m_\pi^2}\rho_V,$$

$$\Sigma_{\rho_{vt}} = +\frac{1}{2}\left[\frac{D_{\rho_{vt}}}{2\gamma}\frac{g_\rho^2}{m_\rho^2} Z_{\Omega_\rho}(k_F, m_\rho, m)\right](\rho_V + \rho_S) = +\frac{1}{2}\frac{G_{\rho_{vt}}^2}{m_\rho^2}(\rho_V + \rho_S).$$



New coupling function

example

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$$Y_{\Phi_i}(k_F, m_i) = \left[\frac{9}{4}\frac{m_i^2}{k_F^6} I_{\Phi_i}\right],$$

$$Y_{\Lambda_\pi}(k_F, m_\pi) = \left[\frac{9}{4}\frac{1}{k_F^6} I_{\Lambda_\pi}\right],$$

$$Y_{\Psi_\rho}(k_F, m_\rho) = \left[\frac{9}{4}\frac{1}{k_F^6} I_{\Psi_\rho}\right],$$

$$Z_{\Omega_\rho}(k_F, m_\rho, m) = \left[\frac{9}{4}\frac{1}{m}\frac{m_\rho^2}{k_F^6} I_{\Omega_\rho}\right].$$

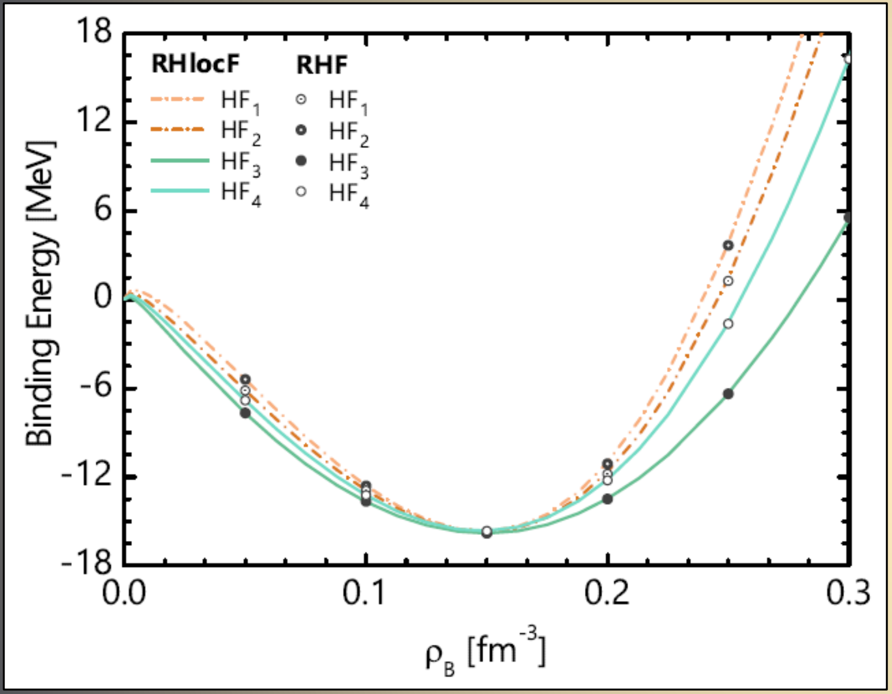
Exchange functions

Covariant DFT with localized Fock

Results – Symmetric matter

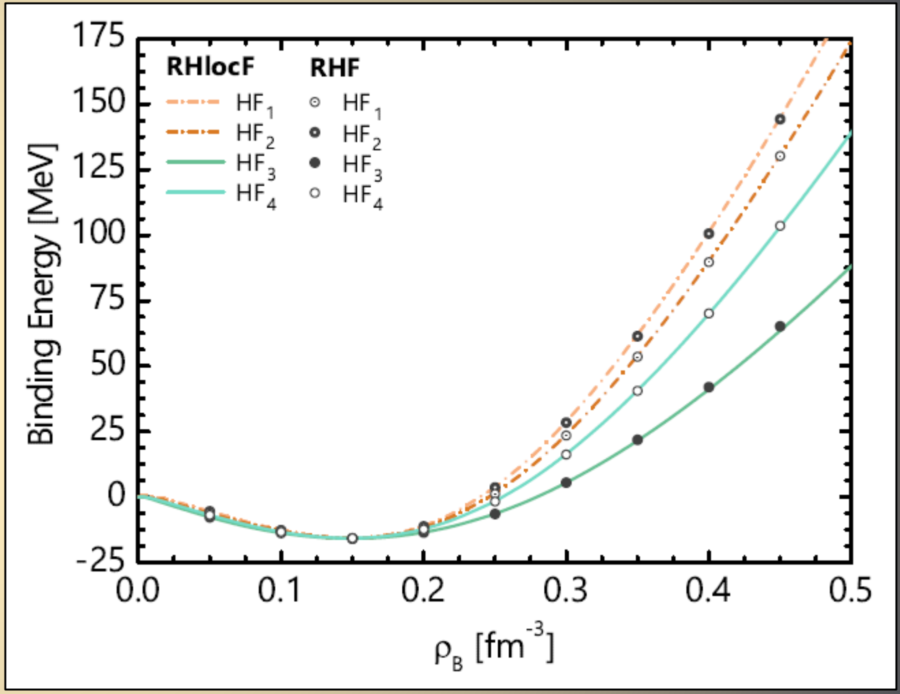
Binding energy

medium densities



HF_1 HF_2 HF_3 HF_4

higher densities



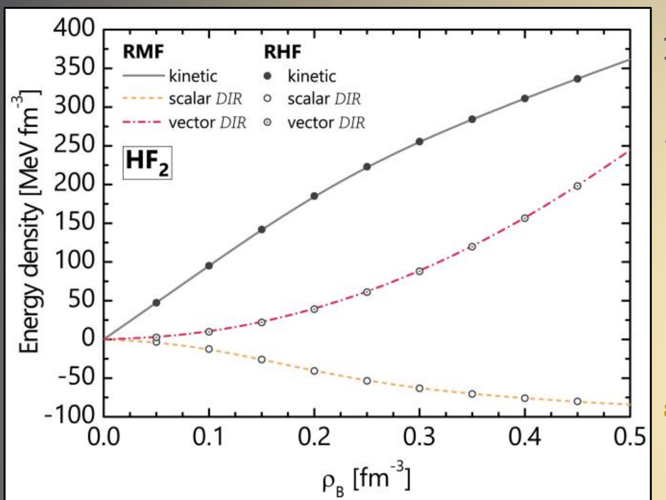
Results

- *Excellent reproduction up to $3\rho_{sat}$*
- *All parametric sets show no relevant deviations*
- *RHF saturation densities well reproduced*

Covariant DFT with localized Fock

Energy density

HF_2



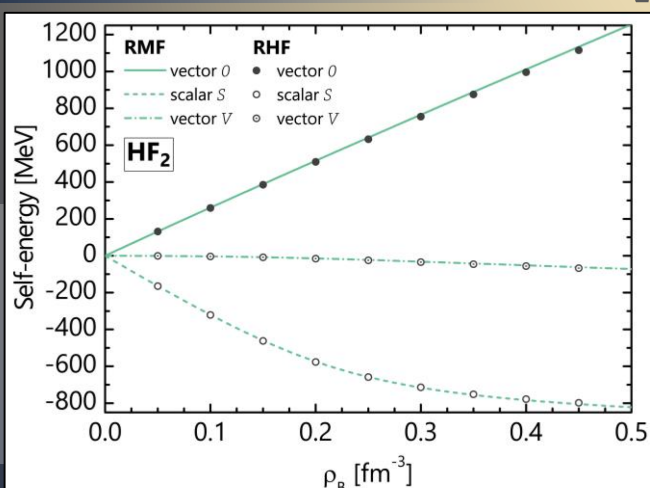
kinetic

vector DIRECT

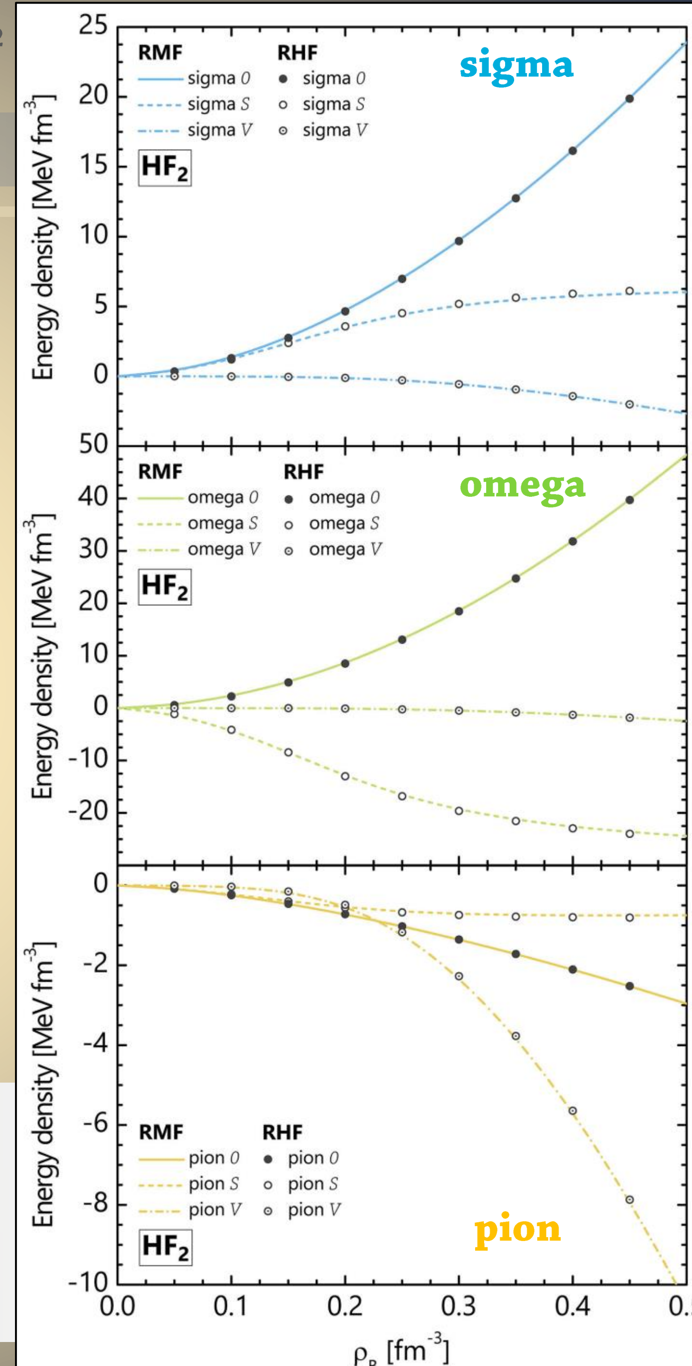
scalar DIRECT

Self-energy

HF_2



HF_2



Results

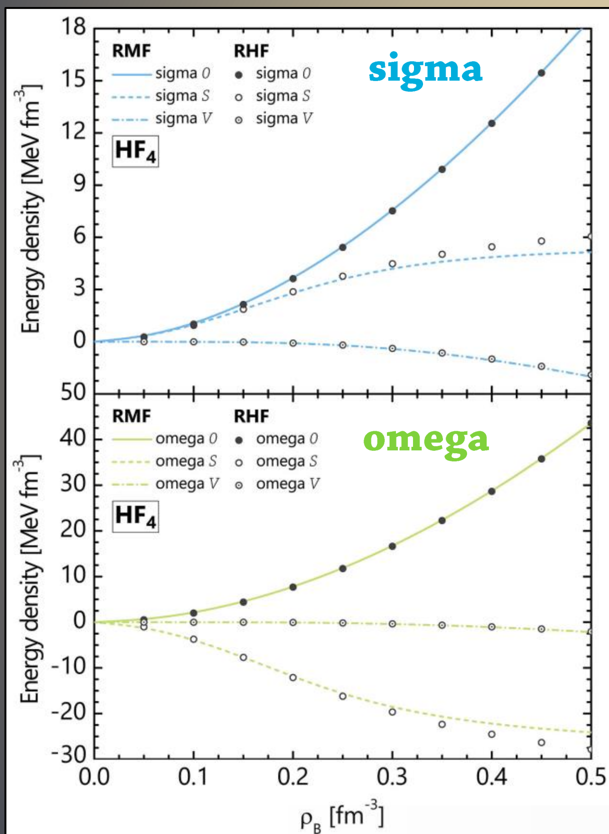
- *Excellent reproduction*
  - *Small differences in the self-energy*

Covariant DFT with localized Fock

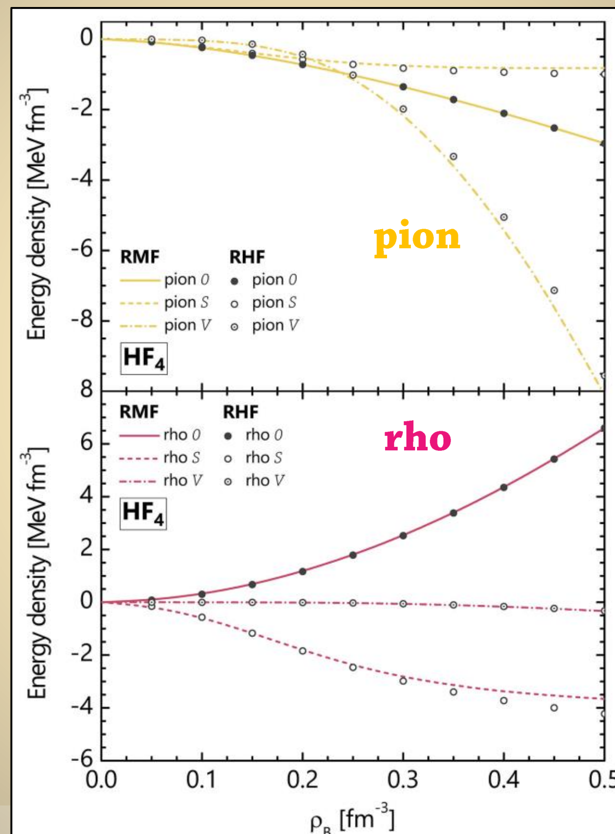
Results – Symmetric matter

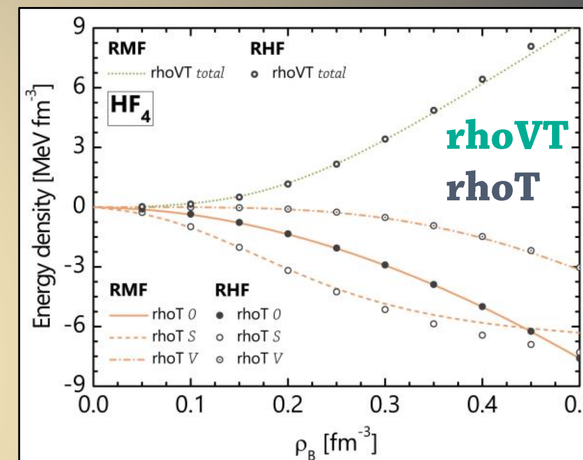
Energy density

HF$_4$



HF$_4$





Results

- *Excellent reproduction up to* $2\rho_{sat}$
- *Mild deviations in the SCALAR channel for higher densities*
- *Scalar density responsible for the differences*

Covariant DFT with localized Fock

Future

1

Density-dependent models

- *PKO1-3, PKA1 parametrizations for RHF model*
- *Rearrangement self-energy*

2

Asymmetric nuclear matter

- *LFA in the asymmetric case*
- *Neutron matter studies*
- *Extension to neutron stars*

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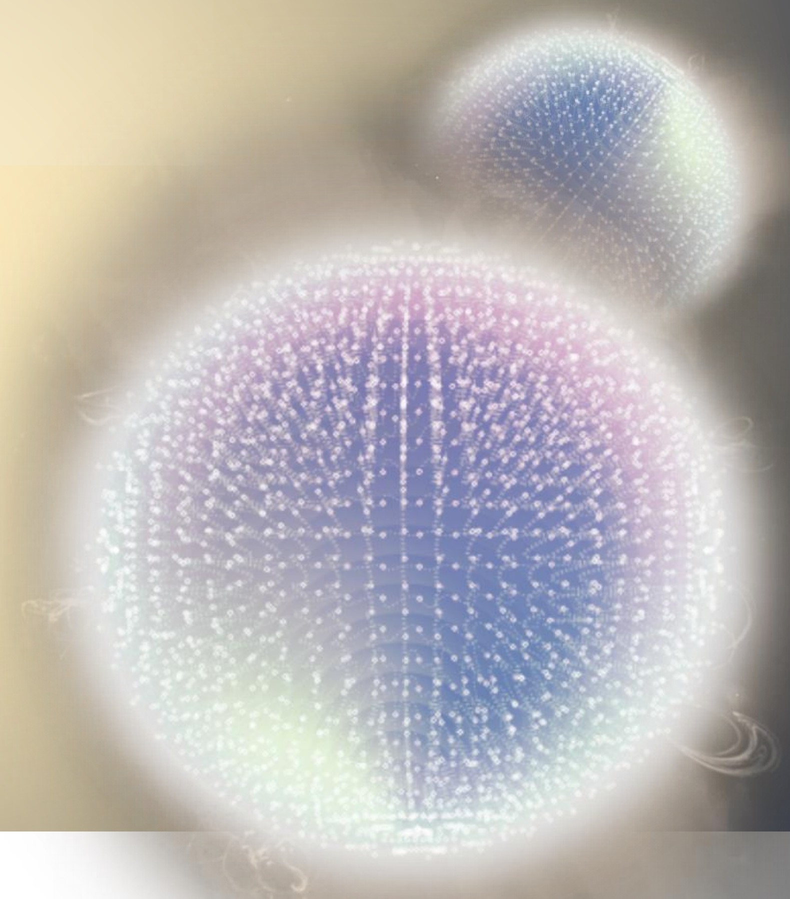
Finite nuclei calculations

- *Finite nuclei in local density approximation*



Thank you!