QMC Calculations
Note 1: Errata
April 13, 2019

Note Author: Daniel L. Whittenbury
Recipients: All recipients ...

- Old Table 4.13.1 on page 92 of my thesis has one typo. This table includes symmetric nuclear matter properties and optical potentials evaluated at saturation density. The typo is
  - The $U_\Sigma = 26$ should read $U_\Sigma = 25$.
- Old Table 5.3.1 on page 106 of my thesis needs several minor corrections, mostly in the value of the Radius. It is off by ~ 0.01 km. We do not list them all here, but the old and new tables are given below with the corrections coloured. Minor bugs were found and corrected. This table contains incompressibility, slope of the symmetry energy and hyperon optical potential evaluated at saturation density with neutron star properties.
- Old Table 5 on page 471 of Physics Letters B 762 (2016) 467–472. This table contains coupling constants, symmetric nuclear matter and hyperon optical potentials at saturation. A bug was found in the NJL mass parametrisation for the cascade only. Only the optical potentials for the cascade were affected. They were off by a few MeV. For all the variations in the paper. The bug appeared in the function `DMDS( )`.
  - Standard: $U_\Xi = -5$ MeV in the table, but it should be -2 MeV.
  - $\Lambda = 1.3$ GeV:$U_\Xi = 5$ MeV in the table, but it should be 9 MeV.
  - Dirac only: $U_\Xi = -19$ MeV in the table, but it should be -15 MeV.
  - $F_\sigma = 1$: $U_\Xi = -14$ MeV in the table, but it should be -10 MeV.

  All other values are unchanged in the table.

Model/ Scenario	$g_{\sigma N}$	$g_{\omega N}$	g_{ρ}	K_0 [MeV]	L_0 [MeV]	K_{sym} [MeV]	Q_0 [MeV]	$K_{\tau,v}$ [MeV]	U_Λ [MeV]	U_{Σ^-} [MeV]	U_{Ξ^-} [MeV]
Standard	8.97	9.38	4.96	273	84	-23	-305	-431	3	26	5
$\Lambda = 1.0$	9.07	9.73	5.05	278	85	-15	-282	-439	10	32	8
$\Lambda = 1.1$	9.16	10.06	5.16	283	86	-8	-261	-446	16	39	11
$\Lambda = 1.2$	9.24	10.37	5.28	286	87	-2	-241	-451	23	46	15
$\Lambda = 1.3$	9.31	10.67	5.40	289	88	4	-224	-456	29	53	18
$\Lambda = 1.1$, $g_{\sigma Y} \times 1.3$	9.16	10.06	5.16	283	86	-8	-261	-446	-15	14	-4
$\Lambda = 1.3$, $g_{\sigma Y} \times 1.3$	9.31	10.67	5.40	289	88	4	-224	-456	-3	28	3
$\Lambda = 2.0$, $g_{\sigma Y} \times 1.9$	9.69	12.27	6.16	302	92	31	-137	-478	-29	20	-7
Increased $f_{\rho N}/g_{\rho N}$	8.70	9.27	3.86	267	81	-34	-321	-424	6	27	6
Fock $\delta\sigma$	9.01	9.44	4.97	273	84	-21	-296	-432	4	26	5
Eff. Proton Mass	10.40	11.0	4.55	297	101	64	-190	-476	11	41	10
Eff. Proton Mass, $\Lambda = 1.1$	11.08	12.31	4.85	311	111	126	-87	-509	34	67	22
Eff. Proton mass + $\delta\sigma$	10.89	11.55	4.53	285	109	132	-232	-432	17	49	13
Dirac Only	10.10	9.22	7.84	294	85	0	-299	-424	-23	4	-8
Hartree Only	10.25	7.95	8.40	283	88	-17	-455	-405	-49	-23	-21
$R = 0.8$	9.30	9.85	4.98	277	85	-15	-269	-443	6	25	5
App. $S_0 = 32.5$	9.05	9.38	4.86	275	82	-27	-303	-429	2	24	4
App. $S_0 = 30.0$	9.31	9.35	4.50	280	74	-24	-298	-391	-4	19	1
$S_0 = 30.0$	9.24	9.36	4.61	278	76	-20	-299	-394	-2	21	2

Table 1: OLD Couplings, nuclear matter properties and selected hyperon optical potentials determined for our standard case (for which $\Lambda = 0.9$ GeV, and $R_N^{\rm free} = 1.0$ fm) and the effect of subsequent variations in which differences from the standard parameter set are indicated in column 1. The tabulated quantities at saturation are the slope and curvature of the symmetry energy, L_0 and K_{sym}, the incompressibility K_0, skewness coefficient Q_0 and the volume component of isospin incompressibility $K_{\tau,v}$, respectively.

Model/ Scenario	$g_{\sigma N}$	$g_{\omega N}$	g_{ρ}	K_0 [MeV]	L_0 [MeV]	K_{sym} [MeV]	Q_0 [MeV]	$K_{\tau,v}$ [MeV]	U_Λ [MeV]	U_{Σ^-} [MeV]	U_{Ξ^-} [MeV]
Standard	8.97	9.38	4.96	273	84	-23	-305	-431	3	25	5
$\Lambda = 1.0$	9.07	9.73	5.05	278	85	-15	-282	-439	10	32	8
$\Lambda = 1.1$	9.16	10.06	5.16	283	86	-8	-261	-446	16	39	11
$\Lambda = 1.2$	9.24	10.37	5.28	286	87	-2	-241	-451	23	46	15
$\Lambda = 1.3$	9.31	10.67	5.40	289	88	4	-224	-456	29	53	18
$\Lambda = 1.1$, $g_{\sigma Y} \times 1.3$	9.16	10.06	5.16	283	86	-8	-261	-446	-15	14	-4
$\Lambda = 1.3$, $g_{\sigma Y} \times 1.3$	9.31	10.67	5.40	289	88	4	-224	-456	-3	28	3
$\Lambda = 2.0$, $g_{\sigma Y} \times 1.9$	9.69	12.27	6.16	302	92	31	-137	-478	-29	20	-7
Increased $f_{\rho N}/g_{\rho N}$	8.70	9.27	3.86	267	81	-34	-321	-424	6	27	6
Fock $\delta\sigma$	9.01	9.44	4.97	273	84	-21	-296	-432	4	26	5
Eff. Proton Mass	10.40	11.0	4.55	297	101	64	-190	-476	11	41	10
Eff. Proton Mass, $\Lambda = 1.1$	11.08	12.31	4.85	311	111	126	-87	-509	34	67	22
Eff. Proton mass + $\delta\sigma$	10.89	11.55	4.53	285	109	132	-232	-432	17	49	13
Dirac Only	10.10	9.22	7.84	294	85	0	-299	-424	-23	4	-8
Hartree Only	10.25	7.95	8.40	283	88	-17	-455	-405	-49	-23	-21
$R = 0.8$	9.30	9.85	4.98	277	85	-15	-269	-443	6	25	5
App. $S_0 = 32.5$	9.05	9.38	4.86	275	82	-27	-303	-429	2	24	4
App. $S_0 = 30.0$	9.31	9.35	4.50	280	74	-24	-298	-391	-4	19	1
$S_0 = 30.0$	9.24	9.36	4.61	278	76	-20	-299	-394	-2	21	2

Table 2: NEW Couplings, nuclear matter properties and selected hyperon optical potentials determined for our standard case (for which $\Lambda = 0.9$ GeV, and $R_N^{\rm free} = 1.0$ fm) and the effect of subsequent variations in which differences from the standard parameter set are indicated in column 1. The tabulated quantities at saturation are the slope and curvature of the symmetry energy, L_0 and K_{sym}, the incompressibility K_0, skewness coefficient Q_0 and the volume component of isospin incompressibility $K_{\tau,v}$, respectively.

Model/ Scenario	K_0 [MeV]	L_0 [MeV]	U_Λ [MeV]	U_{Σ^-} [MeV]	U_{Ξ^-} [MeV]	$M_{\rm max}$ [$M_\odot$]	R [km]	$\rho_c^{\rm max}$ [ρ_0]
Standard	273	84	3	26	5	1.80	11.80	5.88
$\Lambda = 1.0$	278	85	10	32	8	1.84	11.86	5.82
$\Lambda = 1.1$	283	86	16	39	11	1.88	11.94	5.70
$\Lambda = 1.2$	286	87	23	46	15	1.92	12.03	5.60
$\Lambda = 1.3$	289	88	29	53	18	1.95	12.10	5.52
$\Lambda = 1.1$, $g_{\sigma Y} \times 1.3$	283	86	-15	14	-4	1.84	11.91	5.78
$\Lambda = 1.3$, $g_{\sigma Y} \times 1.3$	289	88	-3	28	3	1.92	12.01	5.66
$\Lambda = 2.0$, $g_{\sigma Y} \times 1.9$	302	92	-29	20	-7	2.07	12.24	5.38
Increased $f_{\rho N}/g_{\rho N}$	267	81	6	27	6	1.77	11.61	6.14
Fock $\delta\sigma$	273	84	4	26	5	1.81	11.82	5.86
Eff. Proton Mass	297	101	11	41	10	1.94	12.20	5.48
Eff. Proton Mass, $\Lambda = 1.1$	311	111	34	67	22	2.07	12.57	5.08
Eff. Proton mass + $\delta\sigma$	285	109	17	49	13	1.99	12.22	5.46
Dirac Only	294	85	-23	4	-8	1.79	12.33	5.22
Hartree Only	283	88	-49	-23	-21	1.54	11.73	6.04
Nucleon Only	273	84	3	26	5	2.10	11.08	6.46
$R = 0.8$	277	85	6	25	5	1.83	11.88	5.80
App. $S_0 = 32.5$	275	82	2	24	4	1.80	11.82	5.82
App. $S_0 = 30.0$	280	74	-4	19	1	1.81	11.82	5.76
$S_0 = 30.0$	278	76	-2	21	2	1.81	11.81	5.80

Table 3: OLD Selected nuclear matter properties, hyperon optical potentials and neutron star properties determined for our standard case (for which $\Lambda = 0.9$ GeV, and $R_N^{\rm free} = 1.0$ fm) and the effect of subsequent variations in which differences from the standard parameter set are indicated in column 1. The tabulated quantities at saturation are the incompressibility K_0, the slope of the symmetry energy, L_0, and hyperon optical potentials, respectively. Tabulated neutron star quantities are the stellar radius, maximum stellar mass and corresponding central density (units $\rho_0 = 0.16$ fm^{-3}).

Model/ Scenario	K_0 [MeV]	L_0 [MeV]	U_Λ [MeV]	U_{Σ^-} [MeV]	U_{Ξ^-} [MeV]	$M_{\rm max}$ [$M_\odot$]	R [km]	$\rho_c^{\rm max}$ [ρ_0]
Standard	273	84	3	26	5	1.80	11.80	5.88
$\Lambda = 1.0$	278	85	10	32	8	1.84	11.85	5.82
$\Lambda = 1.1$	283	86	16	39	11	1.88	11.94	5.70
$\Lambda = 1.2$	286	87	23	46	15	1.92	12.02	5.60
$\Lambda = 1.3$	289	88	29	53	18	1.95	12.10	5.50
$\Lambda = 1.1$, $g_{\sigma Y} \times 1.3$	283	86	-15	14	-4	1.84	11.90	5.78
$\Lambda = 1.3$, $g_{\sigma Y} \times 1.3$	289	88	-3	28	3	1.92	11.99	5.68
$\Lambda = 2.0$, $g_{\sigma Y} \times 1.9$	302	92	-29	20	-7	2.07	12.23	5.38
Increased $f_{\rho N}/g_{\rho N}$	267	81	6	27	6	1.77	11.61	6.12
Fock $\delta\sigma$	273	84	4	26	5	1.81	11.83	5.84
Eff. Proton Mass	297	101	11	41	10	1.94	12.19	5.48
Eff. Proton Mass, $\Lambda = 1.1$	311	111	34	67	22	2.07	12.56	5.08
Eff. Proton mass + $\delta\sigma$	285	109	17	49	13	1.99	12.22	5.46
Dirac Only	294	85	-23	4	-8	1.79	12.33	5.22
Hartree Only	283	88	-49	-23	-21	1.54	11.73	6.04
Nucleon Only	273	84	3	26	5	2.10	11.07	6.46
$R = 0.8$	277	85	6	25	5	1.83	11.87	5.80
App. $S_0 = 32.5$	275	82	2	24	4	1.80	11.81	5.84
App. $S_0 = 30.0$	280	74	-4	19	1	1.81	11.81	5.76
$S_0 = 30.0$	278	76	-2	21	2	1.81	11.81	5.78

Table 4: NEW Selected nuclear matter properties, hyperon optical potentials and neutron star properties determined for our standard case (for which $\Lambda = 0.9$ GeV, and $R_N^{\rm free} = 1.0$ fm) and the effect of subsequent variations in which differences from the standard parameter set are indicated in column 1. The tabulated quantities at saturation are the incompressibility K_0, the slope of the symmetry energy, L_0, and hyperon optical potentials, respectively. Tabulated neutron star quantities are the stellar radius, maximum stellar mass and corresponding central density (units $\rho_0 = 0.16$ fm^{-3}).

Model/ Scenario	$g_{\sigma N}$	$g_{\omega N}$	g_ρ	K_0 [MeV]	L_0 [MeV]	U_Λ [MeV]	U_{Σ^-} [MeV]	U_{Ξ^-} [MeV]
Hartree	9.65	6.8	8.54	261	87	-55	-17	-26
Standard	8.29	8.36	4.92	263	81	-5	27	-5
$\Lambda = 1.3$	8.55	9.48	5.24	278	84	16	49	5
Dirac Only	9.41	7.95	7.66	277	82	-33	5	-19
$F_\sigma(\vec{k}) = 1$	8.86	8.11	4.24	259	75	-22	14	-14

Table 5: OLD Couplings, nuclear matter properties, and hyperon optical potentials determined for our standard case (for which $\Lambda = 0.9$ GeV) and variations thereof. The symmetric nuclear matter quantities evaluated at saturation, K_0 and L_0, are the incompressibility and slope of the symmetry energy, respectively. The hyperon optical potentials are evaluated as in Ref. [**?**, **?**].

Model/ Scenario	$g_{\sigma N}$	$g_{\omega N}$	g_{ρ}	K_0 [MeV]	L_0 [MeV]	U_{Λ} [MeV]	U_{Σ^-} [MeV]	U_{Ξ^-} [MeV]
Hartree	9.65	6.8	8.54	261	87	-55	-17	-26
Standard	8.29	8.36	4.92	263	81	-5	27	-2
$\Lambda = 1.3$	8.55	9.48	5.24	278	84	16	49	9
Dirac Only	9.41	7.95	7.66	277	82	-33	5	-15
$F_{\sigma}(\vec{k}) = 1$	8.86	8.11	4.24	259	75	-22	14	-10

Table 6: NEW Couplings, nuclear matter properties, and hyperon optical potentials determined for our standard case (for which $\Lambda = 0.9$ GeV) and variations thereof. The symmetric nuclear matter quantities evaluated at saturation, K_0 and L_0, are the incompressibility and slope of the symmetry energy, respectively. The hyperon optical potentials are evaluated as in Ref. [**?**, **?**].