

# 前兆ニュートリノ検出可能性の系統的研究

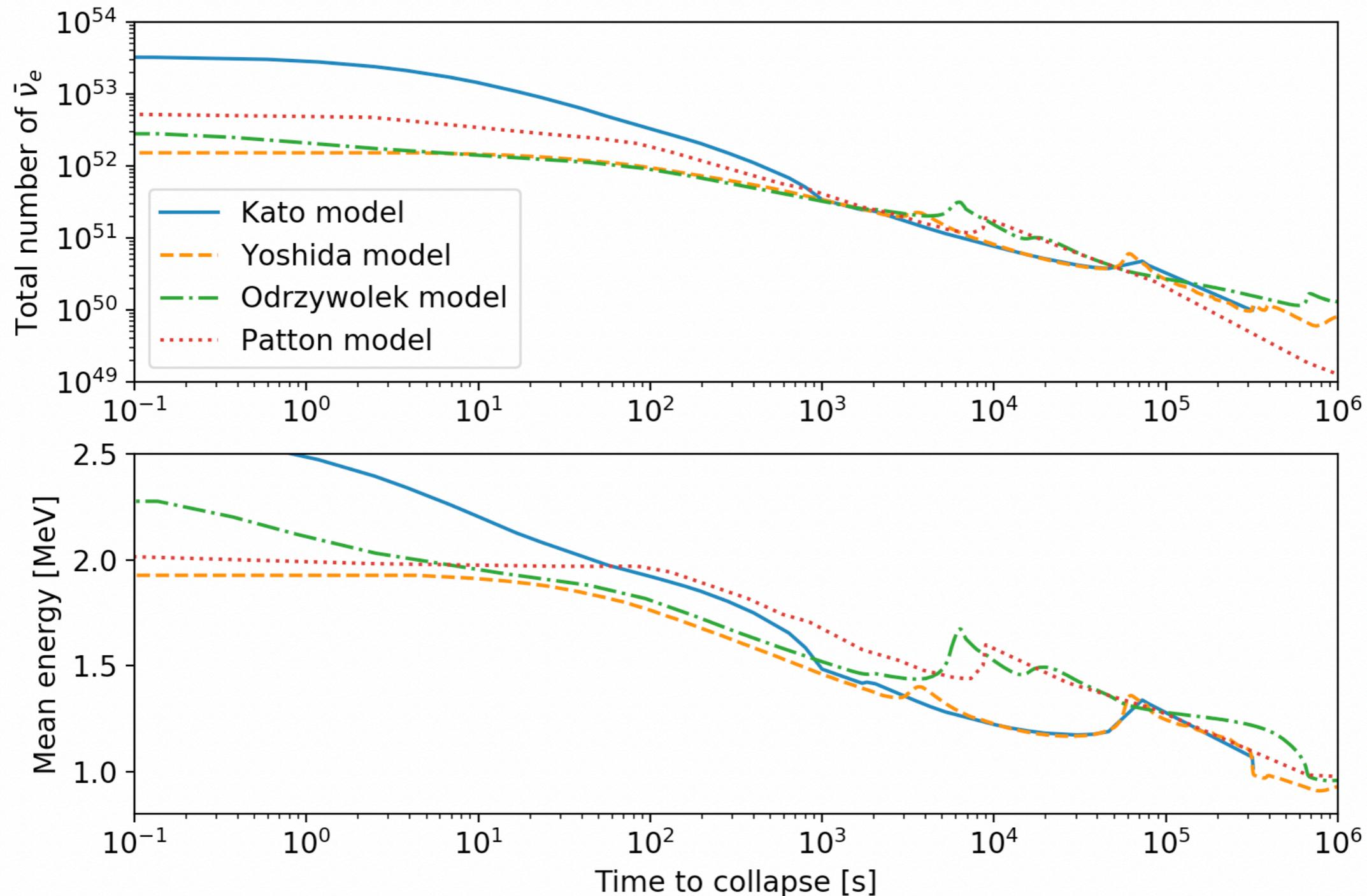
石徹白晃治 (東北大学)

# 前兆ニュートリノ

恒星の核燃焼フェーズで放出されるニュートリノ

爆発のO(1000秒)前までは電子-陽電子の対生成が主な生成プロセス

それ以降は原子核反応が主なプロセスとなる





Detector	Model	$N_S^{\text{DC}}(0.01)$	Detection range [pc]	Detection time [hr]	$T$ [hr]
SK-Gd	Kato	44.1–47.1 (10.2–11.0)	360–470 (170–220)	0.1–0.6 (–0.07)	12
		47.9–51.2 (11.5–12.3)	340–450 (160–220)	0.2–22 (–0.07)	24
		54.4–58.1 (13.5–14.5)	330–440 (160–220)	0.7–32 (–0.07)	48
SK-Gd	Yoshida	19.3–20.6 (11.1–11.9)	250–320 (190–240)	0.1–0.9 (0.1–0.1)	12
		23.7–25.3 (13.6–14.5)	250–330 (180–250)	0.2–4 (0.1–0.2)	24
		25.6–27.2 (14.5–15.55)	230–310 (170–230)	0.1–5 (0.1–0.1)	48
SK-Gd	Odrzywolek	41.5–44.2 (11.8–12.6)	370–470 (190–250)	3–6 (1–2)	12
		43.2–46.1 (12.3–13.1)	330–440 (170–230)	3–6 (1–2)	24
		44.9–47.8 (14.5–15.5)	300–410 (160–210)	2–7 (0.3–2)	48
SK-Gd	Patton	49.0–52.3 (14.8–15.8)	400–520 (220–280)	5–10 (0.09–3)	12
		53.4–56.9 (16.3–17.4)	370–490 (200–270)	5–10 (0.03–3)	24
		55.5–59.1 (17.0–18.1)	340–450 (190–250)	4–1 (0.03–2)	48
KamLAND	Kato	7.8 (1.6)	340–410 (150–190)	0.3–19 (–)	12
		9.6 (2.2)	360–440 (170–210)	25–45 (–0.03)	24
		12.5 (3.0)	400–510 (200–250)	38–50 (–0.1)	48
KamLAND	Yoshida	4.5 (2.4)	260–310 (190–230)	0.5–16 (–0.1)	12
		6.5 (3.5)	290–370 (210–270)	8–18 (0.1–1)	24
		7.7 (4.1)	310–390 (220–280)	15–22 (0.3–7)	48
KamLAND	Odrzywolek	9.8 (2.8)	380–460 (200–250)	5–8 (0.05–1)	12
		11.0 (3.1)	380–480 (200–250)	7–13 (0.09–2)	24
		12.4 (3.5)	390–400 (200–260)	11–38 (0.1–2)	48
KamLAND	Patton	11.9 (3.4)	420–520 (220–270)	8–13 (0.4–3)	12
		14.0 (3.5)	430–540 (230–290)	11–18 (1–4)	24
		15.5 (4.7)	430–550 (240–300)	18–65 (2–6)	48
JUNO	Kato	239.7 (50.0)	960 (440)	76 (47)	12
		295.1 (67.0)	960 (460)	74 (57)	24
		391.1 (96.0)	1050 (520)	73 (56)	48
JUNO	Yoshida	141.7 (75.8)	740 (540)	53 (30)	12
		205.4 (109.4)	810 (590)	67 (39)	24
		247.2 (130.7)	810 (590)	71 (50)	48
JUNO	Odrzywolek	305.6 (86.9)	1090 (580)	107 (14)	12
		346.6 (98.5)	1050 (560)	130 (28)	24
		393.8 (112.0)	1030 (540)	126 (63)	48
JUNO	Patton	371 (105.8)	1190 (650)	121 (21)	12
		437.4 (109.4)	1180 (640)	131 (71)	24
		489.2 (147.1)	1150 (630)	128 (101)	48

Detector	Model	$N_S^{DC}(0.01)$	Detection range [pc]	Detection time [hr]	$T$ [hr]
SK-Gd	Kato	44.1–47.1 (10.2–11.0)	360–470 (170–220)	0.1–0.6 (–0.07)	12
		47.9–51.2 (11.5–12.3)	340–450 (160–220)	0.2–22 (–0.07)	24
		54.4–58.1 (13.5–14.5)	330–440 (160–220)	0.7–32 (–0.07)	48
SK-Gd	Yoshida	19.3–20.6 (11.1–11.9)	250–320 (190–240)	0.1–0.9 (0.1–0.1)	12
		23.7–25.3 (13.6–14.5)	250–330 (180–250)	0.2–4 (0.1–0.2)	24
		25.6–27.2 (14.5–15.55)	230–310 (170–230)	0.1–5 (0.1–0.1)	48
SK-Gd	Odrzywolek	41.5–44.2 (11.8–12.6)	370–470 (190–250)	3–6 (1–2)	12
		43.2–46.1 (12.3–13.1)	330–440 (170–230)	3–6 (1–2)	24
		44.9–47.8 (14.5–15.5)	300–410 (160–210)	2–7 (0.3–2)	48
SK-Gd	Patton	49.0–52.3 (14.8–15.8)	400–520 (220–280)	5–10 (0.09–3)	12
		53.4–56.9 (16.3–17.4)	370–490 (200–270)	5–10 (0.03–3)	24
		55.5–59.1 (17.0–18.1)	340–450 (190–250)	4–1 (0.03–2)	48
KamLAND	Kato	7.8 (1.6)	340–410 (150–190)	0.3–19 (–)	12
		9.6 (2.2)	360–440 (170–210)	25–45 (–0.03)	24
		12.5 (3.0)	400–510 (200–250)	38–50 (–0.1)	48
KamLAND	Yoshida	4.5 (2.4)	260–310 (190–230)	0.5–16 (–0.1)	12
		6.5 (3.5)	290–370 (210–270)	8–18 (0.1–1)	24
		7.7 (4.1)	310–390 (220–280)	15–22 (0.3–7)	48
KamLAND	Odrzywolek	9.8 (2.8)	380–460 (200–250)	5–8 (0.05–1)	12
		11.0 (3.1)	380–480 (200–250)	7–13 (0.09–2)	24
		12.4 (3.5)	390–400 (200–260)	11–38 (0.1–2)	48
KamLAND	Patton	11.9 (3.4)	420–520 (220–270)	8–13 (0.4–3)	12
		14.0 (3.5)	430–540 (230–290)	11–18 (1–4)	24
		15.5 (4.7)	430–550 (240–300)	18–65 (2–6)	48
JUNO	Kato	239.7 (50.0)	960 (440)	76 (47)	12
		295.1 (67.0)	960 (460)	74 (57)	24
		391.1 (96.0)	1050 (520)	73 (56)	48
JUNO	Yoshida	141.7 (75.8)	740 (540)	53 (30)	12
		205.4 (109.4)	810 (590)	67 (39)	24
		247.2 (130.7)	810 (590)	71 (50)	48
JUNO	Odrzywolek	305.6 (86.9)	1090 (580)	107 (14)	12
		346.6 (98.5)	1050 (560)	130 (28)	24
		393.8 (112.0)	1030 (540)	126 (63)	48
JUNO	Patton	371 (105.8)	1190 (650)	121 (21)	12
		437.4 (109.4)	1180 (640)	131 (71)	24
		489.2 (147.1)	1150 (630)	128 (101)	48

Annu. Rev. Nucl. Part. Sci.の一部として投稿済み

Detector	Model	$N_S^{DC}(0.01)$	Detection range [pc]	Detection time [hr]	$T$ [hr]
SK-Gd	Kato	44.1–47.1 (10.2–11.0)	360–470 (170–220)	0.1–0.6 (–0.07)	12
		47.9–51.2 (11.5–12.3)	340–450 (160–220)	0.2–22 (–0.07)	24
		54.4–58.1 (13.5–14.5)	330–440 (160–220)	0.7–32 (–0.07)	48
SK-Gd	Yoshida	19.3–20.6 (11.1–11.9)	250–320 (190–240)	0.1–0.9 (0.1–0.1)	12
		23.7–25.3 (13.6–14.5)	250–330 (180–250)	0.2–4 (0.1–0.2)	24
		25.6–27.2 (14.5–15.55)	230–310 (170–230)	0.1–5 (0.1–0.1)	48
SK-Gd	Odrzywolek	41.5–44.2 (11.8–12.6)	370–470 (190–250)	3–6 (1–2)	12
		43.2–46.1 (12.3–13.1)	330–440 (170–230)	3–6 (1–2)	24
		44.9–47.8 (14.5–15.5)	300–410 (160–210)	2–7 (0.3–2)	48
SK-Gd	Patton	49.0–52.3 (14.8–15.8)	400–520 (220–280)	5–10 (0.09–3)	12
		53.4–56.9 (16.3–17.4)	370–490 (200–270)	5–10 (0.03–3)	24
		55.5–59.1 (17.0–18.1)	340–450 (190–250)	4–1 (0.03–2)	48
KamLAND	Kato	7.8 (1.6)	340–410 (150–190)	0.3–19 (–)	12
		9.6 (2.2)	360–440 (170–210)	25–45 (–0.03)	24
		12.5 (3.0)	400–510 (200–250)	38–50 (–0.1)	48
KamLAND	Yoshida	4.5 (2.4)	260–310 (190–230)	0.5–16 (–0.1)	12
		6.5 (3.5)	290–370 (210–270)	8–18 (0.1–1)	24
		7.7 (4.1)	310–390 (220–280)	15–22 (0.3–7)	48
KamLAND	Odrzywolek	9.8 (2.8)	380–460 (200–250)	5–8 (0.05–1)	12
		11.0 (3.1)	380–480 (200–250)	7–13 (0.09–2)	24
		12.4 (3.5)	390–400 (200–260)	11–38 (0.1–2)	48
KamLAND	Patton	11.9 (3.4)	420–520 (220–270)	8–13 (0.4–3)	12
		14.0 (3.5)	430–540 (230–290)	11–18 (1–4)	24
		15.5 (4.7)	430–550 (240–300)	18–65 (2–6)	48
JUNO	Kato	239.7 (50.0)	960 (440)	76 (47)	12
		295.1 (67.0)	960 (460)	74 (57)	24
		391.1 (96.0)	1050 (520)	73 (56)	48
JUNO	Yoshida	141.7 (75.8)	740 (540)	53 (30)	12
		205.4 (109.4)	810 (590)	67 (39)	24
		247.2 (130.7)	810 (590)	71 (50)	48
JUNO	Odrzywolek	305.6 (86.9)	1090 (580)	107 (14)	12
		346.6 (98.5)	1050 (560)	130 (28)	24
		393.8 (112.0)	1030 (540)	126 (63)	48
JUNO	Patton	371 (105.8)	1190 (650)	121 (21)	12
		437.4 (109.4)	1180 (640)	131 (71)	24
		489.2 (147.1)	1150 (630)	128 (101)	48

Annu. Rev. Nucl. Part. Sci.の一部として投稿済み(の予定でした)

バグ修正も含めて1/9に投稿予定