FIGURE 7.22  Schematic representation of 2D $J$-resolved spectra. In the 1D plot (i), both $\delta$ and $J$ appear along the same axis, but in the 2D $J$-resolved spectrum (ii), the multiplets are rotated by 90° at their respective chemical shifts to generate a 2D plot with the chemical shifts ($\delta$) and coupling constants ($J$) lying along two different axes. (iii) the 2D $J$-resolved spectrum as a contour plot.
1) Heteronuclear 2D $J$-Resolved Spectroscopy

(a) Broad-band $^1$H-decoupled $^{13}$C-NMR spectrum of the di-$O$-methylcrenatin, isolated from *Osyris wightiana* Wall. ex. Wight.;
(b) 2D heteronuclear $J$-resolved spectrum of the same compound in the form of a contour plot;
(c) stacked plot presentation of 2D heteronuclear $J$-resolved spectrum of di-$O$-methylcrenatin.
A heteronuclear 2D J-resolved spectrum of fenchone, isolated from *Illicium religiosum* Sieb, along with a broad-band decoupled spectrum. Only δ 10–45 region is shown, containing signals of protonated carbons. Quaternary carbons, C-2 and C-3, resonate further downfield as singlets (not shown here).
Projection of the peaks onto the $F_1$ axis, therefore, gives the $^1$H-decoupled $^{13}$C spectrum; projection onto the $F_2$ axis produces the fully proton-coupled $^{13}$C spectrum.
2) Homonuclear 2D $J$-Resolved Spectroscopy

FIGURE 7.27  Overlapping triplet “a” and quartet “b”, respectively. $\nu_A$ and $\nu_B$ are the chemical shifts of the two protons.

FIGURE 7.28  (a) Overlapping triplet and quartet of protons A and B, with the chemical shifts and coupling constants along the same axis. (b) Triplet and quartet of the same protons, shown with the chemical shifts lying along the vertical axis, and coupling constants along the horizontal axis separately. (c) Overhead view of the same peaks as in (b) but in the form of contours.
FIGURE 7.31 (a) Homonuclear $J$-spectrum. Since the coupling is both in $v_1$ and $v_2$ dimensions, a 45° tilt is observed. (b) Heteronuclear $J$-spectrum in which coupling appears only in one dimension.

FIGURE 7.32 (a) The methylene protons of ethyl alcohol appear as a quartet with a 45° tilt in the homonuclear 2D $J$-resolved spectrum. (b) The same, but after tilt correction. The stacked plot is presented on the left; the corresponding contour plot appears on the right.
5.2 Menthol

(1R,2S,5R)-5-Methyl-2-(1-methylethyl)cyclohexanol

Fig. 5.2-20 2D J-resolved NMR spectrum
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FIGURE 6.48

Simulation: ttq, $J = 11.89, 3.57, 6.56$ Hz

FIGURE 6.49
A simultaneous multi-slice selective $J$-resolved experiment for fully resolved scalar coupling information

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ABSTRACT

Proton-proton scalar coupling plays an important role in molecular structure elucidation. Many methods have been proposed for revealing scalar coupling networks involving chosen protons. However, determining all $J_{HH}$ values within a fully coupled network remains as a tedious process. Here, we propose a method termed as simultaneous multi-slice selective $J$-resolved spectroscopy (SMS-SEJRES) for simultaneously measuring $J_{HH}$ values out of all coupling networks in a sample within one experiment. In this work, gradient-encoded selective refocusing, PSYCHE decoupling and echo planar spectroscopic imaging (EPSI) detection module are adopted, resulting in different selective $J$-edited spectra extracted from different spatial positions. The proposed pulse sequence can facilitate the analysis of molecular structures. Therefore, it will interest scientists who would like to efficiently address the structural analysis of molecules.
Fig. 2. Illustration of the action of the SMS-SEJRES experiment.
Fig. 3. Conventional $^1$H 1D spectrum (a) and 2D spectra obtained by SMS-SEJRES (b, c, d and e) of n-Butyl bromide. Spectra in (b), (c), (d) and (e) correspond to scalar coupling networks of protons H1, H2, H3 and H4, respectively.

Fig. 4. F1 projections of multiplets in Fig. 3(b)-(e).
Fig 5. Conventional $^1$H 1D spectrum (a) and 2D spectra obtained by SMS-SJEJRES (b, c, d and e) of L-menthol. Spectra in (b), (c), (d) and (e) correspond to scalar coupling networks of protons H7, H5a, H3a and H2a, and H4, respectively. Peaks marked with * and ^ in (b)-(e) denote peaks of TMS and solvent due to aliasing.